

SMITHSONIAN MISCELLANEOUS COLLECTIONS
VOLUME 106, NUMBER 11

Thomas Lincoln Casey Fund

REVIEW OF THE NEW WORLD SPECIES
OF HIPPODAMIA DEJEAN
(COLEOPTERA: COCCINELLIDAE)

(WITH 22 PLATES)

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(PUBLICATION 3855)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
JUNE 14, 1946

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

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REVIEW OF THE NEW WORLD SPECIES OF HIPPO- DAMIA DEJEAN (COLEOPTERA: COCCINELLIDAE)¹

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INTRODUCTION

The present paper is offered as a point of departure for an adequate study of the many intricate and fascinating problems in the taxonomy of this division of the family Coccinellidae. Much more collecting and study will have to be devoted to the species of the *quinesignata*, *sinuata*, and *convergens* groups before a true picture of these species and all their subspecific segregates is revealed. It is hoped that the data assembled here will be of use in that future study.

ACKNOWLEDGMENTS

Without the aid of many individuals, always generously given, this paper could not have been written. The writer thanks them all gratefully: Th. Dobzhansky for the use of his collection of more than 2,000 specimens and for his stimulating advice and encouragement; John E. Blum, O. L. Cartwright, J. C. Chamberlin, Wm. L. Jellison, G. P. MacKenzie, F. T. Scott and others for smaller collections of critical material which made possible the solution of certain problems encountered; Gerhard H. Dieke and P. H. Timberlake, who have read portions of the manuscript and offered valuable suggestions. Thanks are also due Mrs. Rhoda F. Mislove for her painstaking labors in preparing hundreds of dissections of specimens, both male and female, and for assistance in the preparation of the distributional maps.

It should be noted that in preparing the drawings showing spot patterns, the elytra have been drawn as plane surfaces to avoid the effect of foreshortening; thus the tips of the elytra appear to be separated.

¹This is the fifth contribution to be published by the Smithsonian Institution under the Thomas Lincoln Casey Fund.

MATERIAL

In all, something over 11,000 specimens of *Hippodamia* have been examined. The National collection, with the collections of Thos. L. Casey, H. F. Wickham, and the Brooklyn Museum of Arts and Sciences, contains nearly 9,000 specimens, including representatives of all known species and subspecies. Next in importance is the Dobzhansky collection of more than 2,000, rich in material from the far West and from Mexico and Central America. Other small but important lots were made available by interested colleagues.

It is to be regretted that no adequate samples of the various palae-arctic species are available to the writer and therefore this paper must confine itself to the New World components of the genus.

HISTORICAL

Dejean, in his "Catalogue des Coléoptères," 3d edition, p. 456, 1836, introduced the generic name *Hippodamia* into literature. Although he credits the name to Chevrolat, it appears that Dejean's use antedates that of Chevrolat. Eleven species, with synonyms, were included, but no type species was designated. Mulsant (1850) accepted the genus in approximately the same sense as Dejean's and also failed to designate a genotype. Crotch (1874) selected *Coccinella 13-punctata* L., as genotype. This, through synonymy, was one of the originally included species.

Prior to 1919, all workers who dealt with species in the genus *Hippodamia* Dejean were concerned solely with the external appearance of the individuals. This species differed from that one because of the presence or absence of a spot on the elytron. The result was chaos, for, without exaggeration, it may be stated that except for a few it is absolutely impossible to identify a "described" species unless one has access to the type material.

In his 1919 paper (Journ. New York Ent. Soc., vol. 27, pp. 162-174) P. H. Timberlake laid the foundation for an adequate classification of the genus as it exists in the New World. Four groups of species were recognized at that time. Of these the present writer accepts three with the same limits placed upon them by Timberlake, divides his fourth group into two coordinate groups, and proposes another and new group for a recently described species.

THE GENUS HIPPODAMIA

The genus *Hippodamia* is a not large genus of Coccinellidae whose species show an inordinate amount of variation in the pronotal and

elytral markings. Its species are found throughout the holarctic region, but because of a lack of material from the palaearctic area the present study is confined to the species of the New World.

It may be defined as containing those species of Coccinellidae in which the femora extend beyond the sides of the body when directed outwardly, in which the pronotum is without basal marginal bead and with nearly straight anterior margin, with claws toothed at middle, with first tarsal segment of male rarely dilated, with two spurs on each middle and hind tibia and without metacoxal arcs.

The sclerotized portions of the male genitalia conform to a pattern which is found in most parts of the family. The following description of the organ as it is in *H. parenthesis* (Say) serves well as an example. The terms employed are those used by Dobzhansky (following Verhoeff) and have been adopted because they appear to have been more widely used than any of the other terminologies. Synonymous terms are given in parenthesis.

The *sipho* (aedeagus, median lobe) is in the form of a tube, U-shaped when relaxed and at rest, straight when extended during copulation. At its basal end it is hinged to the free extremity of the *trabes*. To accommodate this attachment, the basal extremity is flattened and widened, somewhat rounded and with a minute median notch. The sperm duct enters at a pore on the outer side just in front of the flattened portion and somewhat in front of this pore but on the inner side there is a pronounced bump or protuberance. The basal third of the *sipho* is heavily sclerotized and pigmented. At the beginning of the middle third, the inner side is not sclerotized but membranous, which tends to increase the flexibility of the organ. Near the apex, the inner side again becomes completely sclerotized while the outer side is membranous and furnished with a lateral, triangular or rounded flap on either side. The extreme apex is very slender and terminates in delicate fingerlike processes.

The *basal plates* (tegmen, theca) are fused into a ring through which the *sipho* passes. This ring is broad above and very narrow beneath, at which point the *trabes* is attached. The *paramera* are articulated at either side of the *penis*.

The *penis* (posterior lobe of theca) is a more or less triangular sclerite, intimately fused with the *basal plates* and lying between the *paramera*. Its apex is acute and barbed. With the *ventral alae*, it forms the guide for directing the *sipho* during copulation.

The *paramera* (lateral lobes) are paired structures arising from the *basal plates*, somewhat finger-shaped and furnished in their apical thirds with moderately long hairs.

The *ventral alae* are paired structures lying along the margins of the *penis* and attached to that sclerite by membrane. Their other margins are free and apically each is extended in a slender process. The *ventral alae* and *penis* together form a three-sided channel through which the *sipho* slides.

The *trabes* (strut) is short and somewhat triangular, is attached at its base by an articulation to the *basal plates*, and at its apex by muscles to the proximal end of the *sipho* at its base. It functions in the extension and retraction of the *sipho*.

The sclerotized portions of the female genitalia are of little use in separating closely related species but may be used in defining the groups of species. The description given below is generalized and does not apply in its entirety to any one species.

The *bursa copulatrix* (uterus) is a more or less elongate sac arising just behind the dorsal and ventral plates (sternite and tergite VIII). It is usually unlined but in the *tredecimpunctata* group it bears on its inner wall patches of short conical spines.

Leading away from the *bursa copulatrix* at or near its upper end is the *sperm duct*, a delicate tube whose union with the bursa is strengthened by the heavily sclerotized *accessory piece*. The form of this *accessory piece* varies somewhat with the groups of species.

At the other end of the *sperm duct* is the very heavily sclerotized sausage-shaped *receptaculum seminis*. Its shape is quite constant in the species of *Hippodamia*, but in many genera of Coccinellidae it offers excellent specific characters.

GROUP I—TREDECIMPUNCTATA

This group is characterized by the somewhat oblong rather than oval body form (due chiefly to the relatively greater width of the pronotum); in the male sex by the strong development of the ventral alae of the penis, and by the small, subtriangular, closely approximated dorsal flaps of the *sipho*; and in the female sex by the numerous fine dark sclerotized denticles which line portions of the *bursa copulatrix*.

The *tredecimpunctata* group contains four species, all of which are represented in the Western Hemisphere. The typical species, *H. tredecimpunctata* (L.), breaks up into three subspecies, two of which, *H. tr. tredecimpunctata* (L.) and *H. tr. timberlakei* Capra, are from the Old World. The third, *H. tr. tibialis* (Say), is widely distributed over the northern half of North America. Closely related to the above is the usually misidentified *H. americana* Crotch, whose range, according to our present knowledge, is restricted to the area from

Hudson Bay south to Lake Superior and west to Saskatchewan. Two other species, closely allied inter se but distinctly separated from *tredecimpunctata* and *americana*, belong in this group. These are *H. falcigera* Crotch from Canada and the northern Rocky Mountains area and *H. washingtoni* Timberlake from the States of Washington and Oregon.

HIPPODAMIA TREDECIM-PUNCTATA (L.)

FIGS. 1-9, 29, 48-55, 227

Coccinella 13-punctata LINNÉ, 1758, Syst. Nat., ed. 10, p. 366.

Hippodamia tredecim-punctata MULSANT, 1850, Species Coléopt. Trim. Sécurité-palpes, p. 10; 1866, Monogr. Coccinellides, pt. 1, p. 8.

Hippodamia 13-punctata CROTCH, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 368; Casey, 1899, Journ. New York Ent. Soc., vol. 7, p. 77; Johnson, 1910, Carnegie Inst. Washington, Publ. 122, p. 50.

Coccinella tibialis SAY, 1824, Journ. Acad. Nat. Sci. Philadelphia, vol. 4, p. 94.

Hippodamia tibialis TIMBERLAKE, 1919, Journ. New York Ent. Soc., vol. 27, p. 165; Korschefsky, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 331.

Hippodamia tibialis subsp. *timberlakei* CAPRA, 1931, Boll. Soc. Ent. Italiana, vol. 63, p. 17.

This species with its subspecies inhabits the holarctic region. The typical subspecies is distributed generally over Europe and western Asia and the subspecies *H. tr. timberlakei* Capra in Japan, China, and eastern Siberia. These subspecies need no further discussion in this paper. The remaining subspecies, *H. tr. tibialis* (Say), is North American and is widely distributed in the area north of the 37th parallel of latitude. Rarely is it found as far south as South Carolina.

HIPPODAMIA TR. TIBIALIS Say

Type locality.—"Missouri."

Characterized by the disk of the pronotum being largely black, without oblique white marks and with the elytral pattern of the full component of spots.

H. tr. tibialis is in general a very constant subspecies, showing only slight variation in its color pattern, not at all comparable to that displayed by the typical subspecies in Europe. Individuals having two or more of the spots coalesced are rare, and in the series of more than 550 individuals that is before me, there is no specimen which lacks completely any one of the normally occurring spots. Through the kindness of Dr. J. C. Chamberlin, more than 300 specimens of this species from Matanuska, Alaska, have been available for study.

The lateral prolongations of the ventral alae are moderately long

and rounded at their tips, the marginal prolongations are somewhat longer, bent outward at their middle and terminate in acute, somewhat feebly hooked apices. The penis is broadly triangular at its apex, which is not reflexed. The denticles which occur on the inner wall of the bursa copulatrix are distinctly grouped in four longitudinal bands.

HIPPODAMIA AMERICANA Crotch

FIGS. 10, 30, 56-57, 228

Hippodamia americana CROTCH, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 368; Wickham, 1894, Can. Ent., vol. 26, p. 306; Johnson, 1910, Carnegie Inst. Washington, Publ. 122, p. 52, fig. 39; Korschevsky, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 338.

Type locality.—Hudson Bay.

Crotch described this species, without designating a holotype, as from "Kansas, Hudson Bay." In his 1910 paper, Johnson set Hudson Bay as the type locality and that fixation is accepted here. The Kansas record certainly refers to another species (*spuria* Lec.?).

Little can be said concerning the variation in the spot pattern on the elytra. The linking of spot 3 with its counterpart across the suture at right angles to the elongation of spot $\frac{1}{2}$ appears to be an important characteristic of this species. The absence of spot 2 and the tendency of spots 1, 5, 4, and 6 to join to form a longitudinal stripe suggests a close relationship between *americana* and *falcigera*.

The lateral prolongations of the ventral alae are short, and abruptly rounded, the marginal prolongations are longer, more slender, somewhat bent outward and terminate in simple subacute apices. The penis is acutely triangular at its apex, which is reflected at its extreme tip. Denticles of the bursa copulatrix arranged much as in *tr. tibialis*.

There is a single male specimen of this species in the national collection which was taken by Hubbard and Schwarz on Whitefish Point, Lake Superior, Mich. A female from Waskesu, Saskatchewan, June 10, 1938, C. Shaw, collector, was made available for study by the kindness of F. T. Scott. No other specimens have been seen by me.

HIPPODAMIA FALCIGERA Crotch

FIGS. 11, 31, 58-62, 229

Hippodamia falcigera CROTCH, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 368; Casey, 1899, Journ. New York Ent. Soc. vol. 7, p. 81; 1908, Can. Ent., vol. 40, p. 399; Johnson, 1910, Carnegie Inst. Washington, Publ. 122, p. 55.

Hippodamia sinuata subsp. *albertana* CASEY, 1924, Mem. Coleopt., vol. 11, p. 157.
Ceratomegilla cottlei NUNENMACHER, 1934, Pan-Pacific Ent., vol. 10, p. 20.

Type locality.—Slave Lake, Hudson Bay.

Nine specimens available to me for study come from Edmonton, Alberta (including the type material of *H. s. albertana*), Yellowstone Park, Wyo. (type locality of *C. cottlei*), Moscow, Idaho, Hudson Bay and Stewart River, Yukon Territory. This species does not appear to vary greatly in its markings or size; one specimen shows an unusual lack of pigment in the pronotum and another has the discal vittae of the elytra broken in two parts. The extension of spot $\frac{1}{2}$ as a sutural stripe and the absence of spots 2 and 3 appear to be characteristic.

The lateral prolongations of the ventral alae are long, well sclerotized and terminate in strong, outwardly directed hooks. The marginal prolongations are straight and acute. The penis is broadly rounded with a narrow truncate apical termination. The denticles of the bursa copulatrix form a single patch instead of being arranged in four bands.

HIPPODAMIA WASHINGTONI Timberlake

FIGS. 12, 33, 63-67, 230

Hippodamia washingtoni TIMBERLAKE, 1939, Proc. Hawaiian Ent. Soc., vol. 10, p. 265.

Type locality.—Longmire Spring, Mount Rainier, Wash.

Twenty-three specimens, including two paratypes, are available for study. Of these, 15 were collected at Hoquiam, Wash., four in the Blue Mountains of Oregon, and two on Mount Hood, Oreg.

The pigmentation of the pronotum varies only slightly in the series of specimens before me, but there is a considerable range in the elytral pattern in the Hoquiam series. No evidence of subspeciation can be detected, however, as the series is evenly graded from heavy to light pigmentation. This is the only species of the group which occurs minus all its elytral spots. In spotted individuals, it appears to be characteristic for spots $\frac{1}{2}$ and 3 to be linked with their counterparts to form an inverted T-shaped spot. Spot 2 is usually present.

The lateral prolongations of the ventral alae are long, as in *falcigera*, but are only slightly turned outward at their tips. The penis is more elongate and its apical termination is broader than in *falcigera*. The denticles of the bursa copulatrix are in a single patch.

GROUP II—PARENTHESIS

The parenthesis group is characterized by the rather small oval form, by the single median marginal pale spot on the base of the pro-

notum, by the frequent linkage of spots $\frac{1}{2}$ and 3, the usual suppression of spot 2 and the usual linkage of spots 5, 4, and 6; in the male sex by the low, elongate dorsal flaps of the siphon and in the female sex by the thin collar at the distal end of the accessory piece beyond the limit of heavy sclerotization.

The group contains four species, all of which are of North American origin and no one of which is known to occur naturally in the Old World. These, in chronological order of their description, are *parenthesis* (Say), widely distributed from the Atlantic to the Pacific, *lunatomaculata* Mots., *apicalis* Casey, and *expurgata* Casey, the last three in western North America. Two of these appear to be separable into two subspecies each.

HIPPODAMIA PARENTHESIS (Say)

FIGS. 13, 34, 68-73, 231

Coccinella parenthesis SAY, 1824, Journ. Acad. Nat. Sci. Philadelphia, vol. 4, p. 93.

Adonia parenthesis MULSANT, 1850, Species Coléopt. Trim. Sécuripalpes, p. 40.

Hippodamia parenthesis CROTCH, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 368;

Casey, 1899, Journ. New York Ent. Soc., vol. 7, p. 81; Leng, 1903, loc. cit., vol. 11, p. 44; Casey, 1908, Can. Ent., vol. 40, p. 399; Johnson, 1910, Carnegie Inst. Washington, Publ. 122, p. 52; Timberlake, 1919, Journ. New York Ent. Soc., vol. 27, p. 165; Korschefsky, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 343.

Coccinella tridens KIRBY, 1837, in Richardson, Fauna Boreali-Americana, pt. 4, p. 229; Crotch, 1874, Revision Coccinellidae, p. 97.

Type locality.—"United States."

Notwithstanding the fact that this is a common species over a wide range, the variation in the color pattern is less than in some of the other geographically more restricted species. It may be noted that there is only a slight tendency for spot 1 to join with the subapical lunule (spots 5, 4, and 6) to form a longitudinal discal stripe, and there is no tendency at all for the subapical lunule to be extended in the direction of the apical angle. Also, the reduction of pigmentation of the elytra is not coordinated with a reduction of pigmentation of the pronotum. On the contrary, the specimen before me that shows the least pigment in the elytra shows at the same time an extension of pigment in the pronotum which completely obliterates the median basal pale spot. This particular specimen is the only one of the more than 300 specimens which completely lacks the spot.

The species may be immediately recognized by the barbed apex of the penis.

The range of this species extends from the north Atlantic seaboard west to Alaska, British Columbia, and California and it is the only one of the group known to live east of the Mississippi River. In the east it occurs as far south as South Carolina and to the north into Ontario, Canada. A definite type locality was not given in the original publication, and the type specimen is lost.

HIPPODAMIA APICALIS Casey

FIGS. 14, 35, 74-86, 232

Hippodamia apicalis CASEY, 1899, Journ. New York Ent. Soc., vol. 7, p. 81; 1908, Can. Ent., vol. 40, p. 399; Johnson, 1910, Carnegie Inst. Washington, Publ. 122, p. 54.

Hippodamia lunatomaculata subsp. or var. *apicalis* TIMBERLAKE, 1919, Journ. New York Ent. Soc., vol. 27, p. 166.

Hippodamia lunatmarginata ab. *apicalis* KORSCHESKY, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 342.

Hippodamia lengi JOHNSON, 1910, Carnegie Inst. Washington, Publ. 122, p. 55; Timberlake, 1919, Journ. New York Ent. Soc., vol. 27, p. 167.

Adalia nigromaculata NUNENMACHER, 1934, Pan-Pacific Ent., vol. 10, p. 20. (= *lengi* Johnson.)

The apex of the penis is simple and the apical portion is not set off from the main portion by a sudden constriction producing sharp lateral angles as in *H. expurgata* Casey.

Roughly, the distribution of this species is in a horseshoe-shaped area extending from Colorado north to British Columbia and thence south through California. As yet no specimen has been seen from Arizona or New Mexico, where the related *H. expurgata* Casey is abundant.

HIPPODAMIA A. APICALIS Casey

Type locality.—Reno, Nev.

This subspecies is characterized, in its more heavily pigmented forms, by a strong tendency for the humeral spot and subapical lunule to unite and form a longitudinal discal stripe. Further, the reduction of the pigmented areas of the elytra is in general coordinated with a similar reduction of pigment of the pronotum. Lastly, except in rare cases, the elytral suture at apex carries a trace of dark pigment even in specimens where the pigment reduction has been the greatest.

The range of this subspecies is that of the species except for its apparent absence from southern California.

HIPPODAMIA A. LENGI Johnson

Type locality.—California (San Diego County?).

In this subspecies there is no tendency visible toward the forma-

tion of longitudinal discal stripes. Instead, the suture is dark throughout its length and in specimens with intensified pigment, the humeral spots are joined with the scutellar spot. Nowhere else in this group of species does one find a black sutural stripe. As in the typical subspecies, the pigmentation of the pronotum is coordinated with that of the elytra.

At present this subspecies is known only from San Diego County, Calif. A short series from Jacumba is available for study.

HIPPODAMIA LUNATOMACULATA Motschulsky

FIGS. 16, 36, 87, 97-106, 234

Hippodamia lunatomaculata MOTSCHULSKY, 1845, Bull. Acad. Nat. Sci., Moscow, vol. 18, p. 382, pl. 7, figs. 8, 8'; Timberlake, 1919, Journ. New York Ent. Soc., vol. 27, p. 167 (part).

Hippodamia parenthesis CASEY, 1899, Journ. New York Ent. Soc., vol. 7, p. 81 (part); Johnson, 1910, Carnegie Inst. Washington, Publ. 122, p. 53 ("subspecies of Oregon").

Hippodamia lunatomarginata KORSCHESKY, 1932, Junk-Schenklung, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 342.

Hippodamia lunatomaculata dobzhanskyi, new subspecies.

The range of this species is from the San Francisco Bay region of California north into Alaska. In external appearance it is not to be distinguished from *H. parenthesis* (Say) in all specimens. The two are, however, amply separated by the form of the male genital organ. The apical portion of the penis in this species is set off from the main portion by a sudden constriction, and its extreme apex is slightly enlarged. As in *H. apicalis*, two subspecies may be distinguished.

HIPPODAMIA L. LUNATOMACULATA Motschulsky

Type locality.—California, vicinity of San Francisco Bay.

The original description of this species is as follow :

78. *Hippodamia lunatomaculata* m. Tab. VII, fig. 8, 8'.

H. septemlunata ? Eschsch. Dej. Cat.

Oblonga, nigra, nitida; ore, antennis, capitis thoracque limbo, clytris que testaceis, his maculis nigris septem 1, $\frac{1}{2}$, 1, 1.

Long. 2 $\frac{1}{2}$ lign.—larg. 1 $\frac{3}{4}$ lign.

Par sa taille et ses couleurs cette espèce ressemble à la *H. mutabilis*, mais elle est plus grande. Les élytres sont testacées avec une tache noire commune sous l'écusson, une autre de la même couleur à l'angle huméral, une troisième sur le milieu et une tache allongée en forme de lunule vers l'extrémité. Sur les bords latéraux des segments de l'abdomen on voit des taches blanches.

Elle se trouve en Californie et je crois que c'est à cette espèce qu'il faut rapporter l'*H. septemlunata* du Catalogue du Comte Dejean, au moins c'est la

seule espèce de ce genre que j'ai pu trouver parmi les Californiens de feu Eschscholtz.

Eschscholtz visited California twice, both times as naturalist attached to the expeditions of Otto von Kotzebue. On the first voyage, 1815-1818, von Kotzebue took the *Rurik* into San Francisco Bay, where she stayed from October 1 to November 1, 1816. She departed on the latter date for the Hawaiian Islands. On the second voyage, 1823-1826, the *Predpriatie* dropped anchor at the same place on September 27, 1824, and remained there until the 25th of November of that same year. During this period, field trips were made as far south as Santa Clara and as far north as Ross Colony (Fort Ross), 80 miles north of San Francisco Bay. An expedition was also made up the Sacramento River for some miles. Therefore the actual type locality of *Hippodamia lunatomaculata* Mots. is within 80 miles of San Francisco Bay.

Among the specimens submitted to me for study by F. T. Scott, there is a single specimen from Half Moon Bay, Calif. It is fortunately a male, and an examination showed it to belong, not to *parenthesis* (Say) which it superficially resembles, but to the species which lives mainly along the coasts of Oregon and Washington. Its color pattern (fig. 102) compares very favorably with that illustrated by Motschulsky for the type of *lunatomaculata* (fig. 87). With this specimen I associate a series of 16 specimens taken by Th. Dobzhansky at Willows, Calif. These individuals are characterized by the heavy pigmentation of the pronotum and the unusually light pigmentation of the elytra, and I consider them also to be true *H. lunatomaculata* Mots. With more material available it may become evident that the Willows population should be set apart under a new name.

HIPPODAMIA L. DOBZHANSKYI, new subspecies

Type locality.—Port Angeles, Wash.

Type (male) and 20 paratypes (♂♂ and ♀♀) collected at the type locality August 12, 1934, by Th. Dobzhansky, U.S.N.M. No. 57891. Paratypes in collections of Th. Dobzhansky, G. H. Dieke, F. T. Scott, J. E. Blum, and G. P. Mackenzie.

Form and structure of typical *H. lunatomaculata* Mots. but differing from that form in the notable reduction of pigment in the pronotum coupled with a notable extension of the pigment in the elytra.

This is the dominant form in the coastal areas of Oregon and Washington. To the north, the species is known from Vancouver Island.

HIPPODAMIA EXPURGATA Casey

FIGS. 15, 32, 88-96, 233

Hippodamia parenthesis subsp. *expurgata* CASEY, 1908, Can. Ent., vol. 40, p. 400.*Hippodamia lunatomaculata* subsp. or var. *expurgata* TIMBERLAKE, 1919, Journ. New York Ent. Soc., vol. 27, p. 166.*Hippodamia lunatmarginata* ab. *expurgata* KORSCHIEFSKY, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 342.*Type locality*.—Boulder, Colo.

The color pattern of *H. expurgata* parallels that of *H. apicalis* exactly as the color pattern of *H. lunatomaculata* parallels that of *H. parenthesis*. There is the same tendency to form longitudinal discal stripes in the heavily pigmented forms. The forms with reduced pigmentation show one small point of difference: the dark area at the extreme tip of the suture is usually absent. There also appears to be no correlation between the degree of pigmentation of the elytra and that of the pronotum, which remains moderately heavily pigmented throughout the range of variation. In the more than 260 specimens of this species examined, there is no evidence of subspeciation apparent.

In normal individuals of this species, sides of the penis are parallel nearly to the apex. At about apical fifth, they converge rapidly but without forming acute angles as in *H. lunatomaculata*. The extreme apex is sharply triangular and is turned up at right angles to the main axis of the penis.

Certain individual males from series of otherwise normal individuals have the apical portion of the penis somewhat attenuate as in *H. apicalis*. The degree of elongation does not seem to be constant and it is possible that these are hybrids between *expurgata* and *apicalis*.

This species is essentially a southwestern one with its center of distribution in Utah and Arizona. It is also known from Nevada, Idaho, Wyoming, South Dakota, Nebraska, Colorado, and New Mexico.

GROUP III—GLACIALIS

Two species are the members of a group which is characterized by certain conformations of the male genitalia. The penis carries, near its apex, a transverse wrinkle which has become elevated to form a sharp, high, backwardly directed crest. The margin of the crest is, in *H. quinquesignata*, entire and slightly rounded. In *H. glacialis* the crest is deeply and broadly emarginate. The siphon is also characteristic in that it is strongly swollen or inflated behind the apical flaps.

The apical flaps are reduced in size in *H. quinquesignata* but large in *H. glacialis*. In either case, they are directed forward rather than outward.

Hippodamia quinquesignata (Kby.) embraces, in addition to the typical subspecies, two subspecies inhabiting the West Coast, both of which are characterized by immaculate elytra. *H. glacialis* (F.) is represented in North America by four subspecies, two of limited distribution and two of wider range.

HIPPODAMIA QUINQUESIGNATA (Kirby)

FIGS. 19, 37, 127-146, 237

- Coccinella quinquesignata* KIRBY, 1837, in Richardson, Fauna Boreali-Americana, vol. 4, p. 230, pl. 7, fig. 1.
- Hippodamia quinquesignata* MULSANT, 1850, Species Coléopt. Trim. Sécuripalpes, p. 15; 1866, Monogr. Coccinellides, pt. 1, p. 10; Crotch, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 366; 1874, Revision Coccinellidae, p. 95; Casey, 1899, Journ. New York Ent. Soc., vol. 7, p. 78; Leng, 1903, loc. cit., vol. 11, p. 40, pl. 4; Casey, 1908, Can. Ent., vol. 40, p. 395; Timberlake, 1919, Journ. New York Ent. Soc., vol. 27, p. 171; Korschefsky, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 344.
- "*Hemisphaerica* n. gen., typical species *quinquesignata* Kirby" Hope, 1840, Coleopt. Man., pt. 3, p. 157.
- Hippodamia mulsanti* LECONTE, 1852, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 131; Crotch, 1873, Trans. Amer. Ent. Soc. vol. 4, p. 366; Casey, 1899, Journ. New York Ent. Soc., vol. 7, p. 78; Timberlake, 1919, loc. cit., vol. 27, p. 169. (= *quinquesignata* (Kby.).)
- Hippodamia ambigua* LECONTE, 1852, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 131; Crotch, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 366; Casey, 1899, Journ. New York Ent. Soc., vol. 7, p. 79; Timberlake, 1919, loc. cit., vol. 27, p. 172.
- Hippodamia punctulata* LECONTE, 1852, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 131; Casey, 1899, Journ. New York Ent. Soc., vol. 7, p. 79; Timberlake, 1919, loc. cit., vol. 27, p. 172.
- Hippodamia leporina* MULSANT, 1856, Opusc. Ent., vol. 7, p. 135; Korschefsky, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 344. (= *quinquesignata* (Kby.).)
- Hippodamia obliqua* CASEY, 1899, Journ. New York Ent. Soc., vol. 7, p. 79; Timberlake, 1919, loc. cit., vol. 27, p. 172. (= *ambigua* Lec.)
- Hippodamia subsimilis* CASEY, 1899, Journ. New York Ent. Soc., vol. 7, p. 79; Timberlake, 1919, loc. cit., vol. 27, p. 172. (= *uteana* Csy.)
- Hippodamia vernix* CASEY, 1899, Journ. New York Ent. Soc., vol. 7, p. 79; Timberlake, 1919, loc. cit., vol. 27, p. 171. (= *uteana* Csy.)
- Hippodamia uteana* CASEY, 1908, Can. Ent., vol. 40, p. 397; Timberlake, 1919, Journ. New York Ent. Soc., vol. 27, p. 172.
- Hippodamia uteana quadraria* CASEY, 1924, Mem. Coleopt., vol. 11, p. 156. (= *uteana* Csy.)
- Hippodamia convergens pugetana* CASEY, 1924, loc. cit., p. 156.

H. quinquesignata (Kirby) with its subspecies has essentially a western and northern distribution. Typical specimens predominate in the material seen from Michigan northwestward to Alaska. South from Alaska and more or less following the mountains the maculate forms occur, reaching as far south as Arizona and New Mexico and as far west as central Washington, eastern Oregon, Nevada, and eastern California. The Olympic peninsula of Washington is also to be included in this area. It is possible in long series to differentiate the more lightly marked variety *pugetana* Casey of the Washington district from the more heavily marked variety *uteana* Casey of Utah, Nevada, and eastern California. In general, this species shows a gradual reduction in pigment of the elytra to the west and a gradual increase in pronotal pigment to the south.

The available specimens of this species number more than 1,200. Several very interesting population samples assist greatly in the understanding of the taxonomic problems involved. The more important of these samples are:

Mount Logan, Utah, 9,713 ft., May 13, 1939, Knowlton and Nye, 68 specimens. All specimens heavily maculate, a mixture of typical *quinquesignata* (Kby.) and *uteana* Csy.

Argus Mountains, Calif., 5,500 ft., May 30, 1933, Dobzhansky, 41 specimens. Most of the specimens are *uteana* Csy., a few typical *quinquesignata* (Kby.).

Summit of Peavine Peak, 8,270 ft., near Reno, Nev., January 16, 1923, H. S. Barber, 188 specimens. Most specimens heavily maculate, none immaculate; a few typical *quinquesignata* (Kby.) but most *uteana* Csy.

Port Angeles, Wash., August 12, 1934, Dobzhansky, 72 specimens. Thirty-nine percent (28 specimens) of the lot is a mixture of *q. punctulata* and *q. ambigua*. This is the most northerly record for *q. punctulata* Lec. The remaining individuals are maculate forms of various types, only 3 or less than 4 percent of the whole being typical *quinquesignata*.

Modesto, Calif., fall of 1928, A. O. Larson, 60 specimens. All *q. punctulata* Lec. except for four faintly dotted specimens.

Willows, Calif., June 23, 1932, Dobzhansky, 40 specimens. All but one are *q. punctulata* Lec.

Willamette Valley, Oreg., February 5, 1931, A. O. Larson, 47 specimens. Eight specimens show traces (or more) of maculation (= *obliqua* Csy.); the rest are *H. q. ambigua* Lec.

In the Casey collection, a series of 59 individuals from Fairfield,

Wash.² (apparently part of the large lot studied by Johnson in 1910) has been divided between species as follows: 19 specimens form the type series of *H. convergens pugetana*, 16 were identified as *H. vernix* Csy., 11 as *H. caseyi* Johnson, 10 as *H. spuria* Lec., 2 as *H. americana* Cr., and a single specimen as *H. uteana* Csy. Disregarding for the present the 23 specimens which belong to *spuria* and *caseyi* (*americana* of Casey = *spuria* Lec.), we find nearly every possible spot pattern except those of typical *quinquesignata* and the immaculate subspecies *ambigua* and *punctulata*. It appears significant that in the series of 15,415 specimens analyzed by Johnson, there were no immaculate specimens.

As the material available to me shows that there is no geographic correlation in the distribution of members of the several types of maculation and as there appears no other means of separating these types, I have reduced *H. pugetana* and *H. uteana* to the rank of variety and have maintained the immaculate West Coast forms, *H. ambigua* and *H. punctulata*, as subspecies.

HIPPODAMIA Q. QUINQUESIGNATA (Kirby)

Type locality.—"Lat. 65."

From a study of the itinerary of Richardson's journey, I conclude that this refers to a place near Great Bear Lake.

Specimens agreeing with the original description show a union of spots $\frac{1}{2}$, 1, and 3 to form a transverse bar near the bases of the elytra, the absence of spot 2, the union of spots 4 and 5 to form a transverse subapical bar on each elytron, and the presence of spot 6. The pronotum is furnished with oblique discal marks.

This is the dominant form in the northern part of the range of the species and occurs frequently throughout the range except that it is rare on the Pacific coast.

HIPPODAMIA Q. QUINQUESIGNATA var. PUGETANA Casey

Type locality.—Fairfield, Wash.?

The type specimen has the following pattern: Spots $\frac{1}{2}$ and 3 united,

² If my assumption is correct that Colonel Casey received this material from Mr. Johnson, there is some question whether these specimens came from Fairfield or Kamiack Butte. On page 25 of his 1910 paper, Johnson mentions lots of specimens of 1,406 from Fairfield and 15,415 from Kamiack Butte. Two pages later he states "One large lot taken from the top of Marsh Hill, Fairfield, Washington, contained 15,415 individuals. . . ." It seems unlikely that Johnson counted two separate lots of 15,415 specimens each.

spot 1 is absent, spot 2 feebly developed, spots 4 and 5 well developed, spot 6 similar to spot 2. Pronotal oblique marks well developed.

This variety as well as the next, occurs sporadically throughout the range of the spotted forms of the species.

HIPPODAMIA Q. QUINQUESIGNATA var. UTEANA Casey

Type locality.—Sevier Lake, Utah.

Similar to the last except that spot 1 is present and well developed, spot 2 absent, spots 4 and 5 usually united, and with the pronotal marks reduced or absent.

A commonly met-with variety in Utah and eastern California but by no means confined to that area.

HIPPODAMIA Q. AMBIGUA Leconte

Type locality.—"California and Oregon."

Characterized by the absence of all elytral spots except spot $\frac{1}{2}$ and by the presence of heavy oblique discal marks on the pronotum.

Western Oregon is the center of distribution of this subspecies. Specimens are found on the eastern shore of Puget Sound and occasionally in northwestern California and southern Washington.

HIPPODAMIA Q. PUNCTULATA Leconte

Type locality.—San Francisco, Calif.

Similar to the last in elytral pattern but with the pronotal markings completely or almost completely lacking.

This is the southern counterpart of *H. q. ambigua*. Abundant in western California and the Channel Islands, it is met with occasionally as far north as Port Angeles, Wash.

HIPPODAMIA GLACIALIS (Fabricius)

FIGS. 17-18, 40, 45, 107-126, 235-236

Coccinella glacialis FABRICIUS, 1775, Syst. Ent., p. 80.

Hippodamia glacialis MULSANT, 1850, Species Coléopt. Trim. Sécuripalpes, p. 18; 1866, Monogr. Coccinellides, pt. 1, p. 12; Crotch, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 367; 1874, Revision Coccinellidae, p. 95; Casey, 1899, Journ. New York Ent. Soc., vol. 7, p. 79; Leng, 1903, loc. cit., vol. 11, p. 41; Johnson, 1910, Carnegie Inst. Washington, Publ. 122, p. 19; Timberlake, 1919, Journ. New York Ent. Soc., vol. 27, p. 171.

Hippodamia extensa MULSANT, 1850, Species Coléopt. Trim. Sécuripalpes p. 17; 1866, Monogr. Coccinellides, pt. 1, p. 11; Crotch, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 366; 1874, Revision Coccinellidae, p. 95; Casey, 1899, Journ. New York Ent. Soc., vol. 7, p. 79; Leng, 1903, loc. cit., vol. 11, p. 41; Timberlake, 1919, loc. cit., vol. 27, p. 171.

Hippodamia lecontei MULSANT, 1850, Species Coléopt. Trim. Sécuripalpes, appendix, p. 1010; 1866, Monogr. Coccinellides, pt. 1, p. 9; Crotch, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 366; Casey, 1919, Journ. New York Ent. Soc., vol. 7, p. 78; 1908, Can. Ent., vol. 40, p. 396.

Hippodamia convergens var. *extensa* JOHNSON, 1910, Carnegie Inst. Washington, Publ. 122, p. 23.

Hippodamia convergens var. *lecontei* JOHNSON, 1910, loc. cit., p. 23.

?*Hippodamia convergens* var. *pseudoglacialis* JOHNSON, 1910, loc. cit., p. 23.

?*Hippodamia hoppingi* NUNENMACHER, 1934, Pan-Pacific Ent., vol. 10, p. 21.

Hippodamia glacialis mackenziei, new subspecies.

Unfortunately it is not possible for the writer to place exactly the two forms *Hippodamia convergens* var. *pseudoglacialis* Johnson and *Hippodamia hoppingi* Nunenmacher. The first of these is apparently mentioned only once in Johnson's paper and the entire description is as follows: "Spots $\frac{1}{2}$, 1, 4+5, 6, *pseudoglacialis* (new variety); New Mexico and northward." No type material is mentioned as preserved in any collection. *Hippodamia hoppingi* was described from a short series of specimens from Mt. Stillman, California. There is nothing in the description to indicate whether the species belongs in the *glacialis* or in the *convergens* group. The assignment of the two names to the synonymy of *H. glacialis* is not based on accurate knowledge.

I am unable to separate the three "species" *glacialis* F., *lecontei* Muls., and *extensa* Muls. in a satisfactory manner. All the male specimens of *extensa* available to me have been dissected and the emargination of the transverse crest of the penis does not differ from that in specimens of *lecontei*. As there appears to be no other character of importance by which the two forms may be separated, I have reduced the status of *extensa* to the rank of a subspecies.

When specimens of *glacialis* from eastern United States are compared with specimens of *lecontei* from New Mexico, the two may usually be separated according as the depth of the emargination of the crest is less (*glacialis*) or greater (*lecontei*) than half of the total length of the crest and apical portion of the penis. However, in a series of specimens taken at Watch Hill, R. I., there is noticeable variation from much less than half to nearly half, and in another series from Rocky Ford, Colo., both types with intergrades occur.

There is also a difference to be noticed in the length of the slender tip of the siphon as compared with the length of the dorsal flap. These measurements must be taken from wet or balsam preparations if they are to be of value. In *H. glacialis*, the length of the dorsal flap is generally noticeably less than half as long as the apical portion of the siphon (measured from the origin of the flap to the apex). On the

contrary, the dorsal flap in *H. lecontei* is generally a little more than half the length of the corresponding portion of the siphon. If the length of the flap is expressed as a percentage of the length of the apical portion of the siphon, the values for *H. glacialis* are from 35.7 percent to 40 percent in New England and along the Atlantic coast, to 46.1 percent at Clemson College, S. C., and Lake Okoboji, Iowa. For *H. lecontei*, values of from 45.8 percent to 52.6 percent were measured in a series from Rocky Ford, Colo., other specimens from Idaho and Arizona falling between these limits. The value of the proportion rises again in the far West, reaching a maximum of 57.1 percent in a specimen of *H. extensa* from Alameda County, Calif., and in a specimen of the melanic *H. mackenziei* from Glacier Lodge, Inyo County, Calif.

In view of the variations above noted, I am considering *H. glacialis* (F.) as a widely distributed North American species which breaks up into four reasonably well-defined subspecies.

HIPPODAMIA G. GLACIALIS (Fabricius)

Type locality.—"America boreali."

Characterized by the frequent absence of spots $\frac{1}{2}$, 1, and 2, the habitual absence of spot 3, the habitual linkage of spots 4 and 5, and the presence of spot 6, which is often linked with spot 4. The large majority of specimens will have only spots 4 plus 5 and 6 and with spot 2 feeble or absent. Pronotum usually with oblique discal marks.

Widely distributed over the eastern half of North America, from southeastern Canada south to South Carolina, west to North Dakota, and south through Colorado to Oklahoma and Alabama.

HIPPODAMIA G. LECONTEI Mulsant

Type locality.—Santa Fe, N. Mex.

Given erroneously as "Santa Fe de Bogota" in the original publication.

Compared with the typical subspecies, characterized by a general reduction of pigment of the elytra and by the frequent union of spots $\frac{1}{2}$, 1, and 3 to form a basal transverse bar across the elytra. Pronotal markings absent or feebly defined.

This subspecies occurs in the area immediately west of that occupied by *H. g. glacialis*, that is, from Colorado to Idaho, Utah, and Arizona and south into New Mexico.

HIPPODAMIA G. EXTENSA Mulsant

Type locality.—"Californie septentrionale."

Characterized by the entire absence of spots 2, 4, 5, and 6, and by the frequent linking of spots $\frac{1}{2}$, 1, and 3 to form a basal transverse bar. Pronotum without oblique discal marks.

This subspecies appears to be confined to the coastal area of California in the vicinity of San Francisco. Most specimens seen are from Alameda County.

HIPPODAMIA G. MACKENZIEI, new subspecies

Type locality.—Inyo County, Calif.

Type (male) and paratypes (both sexes) from Glacier Lodge, August 2-8, 1942, G. P. Mackenzie, paratypes (both sexes) from Independence, June 17, 1937, J. E. Blum, U.S.N.M. No. 57892. Paratypes in collections of G. P. Mackenzie, J. E. Blum, Th. Dobzhansky, F. T. Scott, and G. H. Dieke.

Form and structure as in *H. g. glacialis* (Fabr.) but with a general increase in pigmentation. In the series available for study, more than half of the specimens are unusually heavily pigmented. In the darkest individual, spots $\frac{1}{2}$, 1, 3, 4, 5, and 6 are united to form a butterfly-shaped spot covering about two-thirds of the elytra, with spot 2 separate and distinct. The first reduction in this pigmented area, as seen in the series before me, is the freeing of spot 6. Further reduction eliminates spot 2 and gives a pattern similar to *H. g. lecontei*.

Apparently this form is confined to the high mountain area in eastern California.

GROUP IV—CONVERGENS

The species which I have placed together to form group IV, while quite diverse as to elytral pattern, agree in the structure of the male genitalia. The penis is broadly or narrowly triangular and always somewhat attenuate at apex. The tips of the ventral alae project slightly at the sides of the penis near the tip and the paramera are moderate in size and never longer than the penis. The siphon is slender, without a pronounced swelling before the dorsal flaps which are directed forward and upward and somewhat blunt. No species of the group has a transverse crest as in the preceding group but in certain individuals of *H. quindecim-maculata* Muls. there is a fine wrinkle which may be homologous with that crest. The female genitalia are simple, without denticles on the inner wall of the bursa or other conspicuous modifications.

In the present paper five species are assigned to group IV.

HIPPODAMIA QUINDECIM-MACULATA Mulsant

FIGS. 20, 42, 162-166, 238

Hippodamia quindecim-maculata MULSANT, 1850, Species Coléopt. Trim. Sécurité-palpes, p. 20; 1866, Monogr. Coccinellides, pt. 1, p. 12.

Hippodamia 15-maculata CROTCH, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 366; Casey, 1908, Can. Ent., vol. 40, p. 398; Timberlake, 1919, Journ. New York Ent. Soc., vol. 27, p. 167.

Hippodamia convergens subsp. *15-maculata* LENG, 1903, Journ. New York Ent. Soc., vol. 11, p. 42; Johnson, 1910, Carnegie Inst. Washington, Publ. 122, p. 27.

Hippodamia quindecimmaculata KORSCHIEFSKY, 1932, Junk-Schenkling. Coléopt. Catalogus, pars 120, Coccinellidae II, p. 343.

Type locality.—"Les bords du Missouri, dans l'Amérique septentrionale."

This species appears to be neither widespread in its distribution nor abundant in any part of its range. Twenty specimens are available for my study, eleven in the Casey collection and nine in the main National Museum collection.

The spot pattern of this species is unusual in the genus in that there is a well-marked tendency toward the loss of spot $\frac{1}{2}$, which is always reduced and frequently absent. Spots 2 and 3, and 4 and 5 are often united, 1 and 6 are always (?) present.

The most characteristic feature of the male genitalia is the unusually long and attenuated apex of the penis. Most of the males examined have no trace of transverse wrinkle where the transverse crest of the species of the *glacialis* group occurs, but in one from Batchawaung Bay, Lake Superior, this wrinkle is well defined. However, this specimen was prepared with the aid of potassium hydroxide and there appears to have been a certain collapse of parts.

The majority of the specimens examined were taken near St. Louis, Mo. Single specimens from various localities extend the range from Lake Superior south to about 40 miles south of St. Louis, and from Wisconsin and Illinois west to Denver, Colo.

HIPPODAMIA MOESTA Leconte

FIGS. 22, 38, 177-186, 241

Hippodamia moesta LECONTE, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 19; Crotch, 1874, Revision Coccinellidae, p. 97; Casey, 1899, Journ. New York Ent. Soc., vol. 7, p. 78; Leng, 1903, loc. cit., vol. 11, p. 40; Timberlake, 1919, loc. cit., vol. 27, p. 168; Korschefsky, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 342.

Hippodamia lecontei var. *moesta* CROTCH, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 367.

Hippodamia convergens subsp. *moesta* JOHNSON, 1910, Carnegie Inst. Washington, Publ. 122, p. 27.

Hippodamia bowditchi JOHNSON, 1910, loc. cit., p. 45.

Hippodamia politissima CASEY, 1899, Journ. New York Ent. Soc., vol. 7, p. 80; 1908, Can. Ent., vol. 40, p. 395.

Hippodamia ambigua race *politissima* LENG, 1903, Journ. New York Ent. Soc., vol. 11, p. 41.

Hippodamia convergens ab. *politissima* KORSCHESKY, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 339.

This species, which ranges from Colorado, north to Montana, west to British Columbia, and south along the Pacific coast to California, breaks up into three well-marked subspecies. A melanic subspecies (*moesta*) inhabits the West Coast region from Vancouver Island south to northern California. A maculate subspecies (*bowditchi*) centers its distribution in Montana and ranges south to Colorado and west to British Columbia. A third and immaculate subspecies (*politissima*), infrequent in collections, is known from Santa Cruz and San Luis Obispo, Calif.

H. moesta Lec. is evidently rather closely related to *H. quindecim-maculata* Muls., and sufficient material may show that the two should be merged as one.

HIPPODAMIA M. MOESTA Leconte

Type locality.—Prairie Paso, Oreg.

The most extreme case of melanism found in the genus *Hippodamia* and comparable only to *Coccinella prolongata bridwelli* Nun. The average specimen is entirely black above except for the front angles of the pronotum and a pale spot on the elytral margin at about apical fifth. This last-mentioned spot is all that remains of the pale area separating spot 6 from the combined spots 4 and 5.

Very few integrating specimens have been seen but one from Blair's Ranch, Redwood Creek, Humboldt County, Calif., is of more than passing interest. Here the area which would be normally pale in the maculate form is dark red but not sufficiently dark to conceal the normal black markings of the species. This is one of several specimens taken at Blair's Ranch, June 1903, by H. S. Barber. These were found among the individuals of a colony of *Chrysomela scripta* which infested the willows along Redwood Creek. The *Hippodamia* was apparently feeding on the young of the Chrysomelid.

HIPPODAMIA M. BOWDITCHI Johnson

Type locality.—St. Maries, Idaho.

This might be considered as the normal form of the species, that

is, the form comparable to the other species of the genus. Essentially its spot pattern is that of *H. quinquesignata* (Kby.). Spots $\frac{1}{2}$, 1, and 3 are joined to form a heavy transverse basal bar, spot 2 almost always is absent, spots 4 and 5 always (?) joined, and spot 6 is present and discrete.

Through the kindness of Maj. W. L. Jellison, of the Rocky Mountain Laboratory at Hamilton, Mont., the writer has available for study a good series of specimens of this subspecies. These were taken from willows along the Flathead River in the La Salle district, Mont. This is one of the most constant forms to be found in the entire genus, there being no cases of complete suppression of any spot except number 2.

Specimens from Fort Collins and Denver, Colo., Heywood's Corner, Fernie, and Trinity Valley, British Columbia, and numerous localities in Montana have been seen. No specimen has yet been seen from Vancouver Island.

HIPPODAMIA M. POLITISSIMA Casey

Type locality.—Santa Cruz, Calif.

In the absence of evidence to the contrary, the writer is considering this form as a subspecies of *moesta* characterized by the complete suppression of elytral markings.

Two specimens have been seen, both males, and dissections show them to belong to *moesta*. More material should be searched for along the coast of California, south of San Francisco. The true relationship of this form was first pointed out by Timberlake, during one of his visits to the National Museum.

HIPPODAMIA CONVERGENS Guérin

FIGS. 21, 47, 147-161, 239-240

Hippodamia convergens GUÉRIN, 1842, Icon. Regne Animal, vol. 7, (1829-1844), p. 321; Mulsant, 1850, Species Coléopt. Trim. Sécuripalpes, p. 22; 1866, Monogr. Coccinellides, pt. 1, p. 14; Leconte, 1852, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 130; Crotch, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 367; Gorham, 1891, Biol. Centr.-Amer., Coleopt., vol. 7, p. 153, pl. 8, figs. 22-24; Weise, 1895, Ann. Soc. Ent. Belgique, vol. 39, p. 125; Casey, 1899, Journ. New York Ent. Soc., vol. 7, p. 80; Leng, 1903, loc. cit., vol. 11, p. 40, fig. 4; Casey, 1908, Can. Ent., vol. 40, p. 398; Johnson, 1910, Carnegie Inst. Washington, Publ. 122, p. 21 et seq.; Timberlake, 1919, Journ. New York Ent. Soc., vol. 27, p. 168; Korschefsky, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 338; Timberlake, 1943, Hawaiian Planters' Record, vol. 47, p. 11; Bull. Exp. Sta. Hawaiian Sugar Planters' Assoc., Ent. Ser., Bull. 22, p. 11 (reprint of above, without change of pagination).

Hippodamia juncta CASEY, 1899, Journ. New York Ent. Soc., vol. 7, p. 80.

- Hippodamia modesta* MELSHIMER, 1847, Proc. Acad. Nat. Sci. Philadelphia, vol. 3, p. 178; Leconte, 1852, loc. cit., vol. 6, p. 130.
- Hippodamia obsoleta* CROUCH, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 367; Casey, 1908, Can. Ent., vol. 40, p. 398.
- Hippodamia praticola* MULSANT, 1850, Species Coléopt. Trim. Sécuripalpes, p. 23; Weise, 1895, Ann. Soc. Ent. Belgique, vol. 39, p. 125.

Type locality.—Mexico and California.

H. convergens Guér. is by far the commonest and most widespread species of the genus in the New World and is probably the most abundant species of the whole family in that same region. It is generally distributed over southern Canada, the whole United States, Mexico, and Central America as far south as Honduras. Also it has been introduced into Cuba.

Notwithstanding its wide distribution, there is a surprising lack of variation in the spot pattern. Linkage of spots is rare and never extensive; rather, the prevailing type of variation is in the opposite direction, toward the reduction of pigment. In the course of examining about 6,000 specimens of this species, nearly every conceivable variation dealing with reduction or loss of one or more spots was encountered. It would be footless to illustrate all these variations, just as it would be to name them, as is done by certain European writers. Such names merely clutter up the literature to no good end.

Two hibernating lots of this species have been available for study. Both lots were composed only of individuals of *H. convergens* Guér., although at first glance the larger lot seemed to contain numerous specimens of *H. quinquesignata* Kby. Dissection proved these smaller individuals to be merely depauperate and otherwise abnormal *convergens*.

A large lot was collected in December 1945 from a hibernating mass found near the Smithsonian Institution Solar Observing Station at Tyrone, N. Mex., and sent in through the courtesy of Dr. C. G. Abbot. After the fragmentary individuals were discarded, 2,856 specimens were preserved for study. All types of elytral maculation, from immaculate forms to those showing the full component of spots, were observed. The large number of depauperate individuals present was remarkably high; a condition perhaps related to the apparently high percentage of mermithid parasitism.

A second and smaller lot of some 200 specimens was collected September 3, 1945, by Dr. L. G. Henbest on Capulin Volcano, 30 miles south of Raton, N. Mex. Very few of these were undersized, and only one individual was seen to harbor a mermithid.

HIPPODAMIA CASEYI Johnson

FIGS. 24, 39, 187-194, 243

Hippodamia caseyi JOHNSON, 1910, Carnegie Inst. Washington, Publ. 122, pp. 21, 33; Casey, 1911, Mem. Coleopt., vol. 2, p. 250; Casey, 1924, loc. cit., vol. 11, p. 155.

Hippodamia lecontei ab. *caseyi* KORSCHESKY, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 342.

Type locality.—Fairfield, Wash.? There is some doubt as to the exact type locality. None is given definitely but in Johnson's paper the name is directly connected only with specimens from Fairfield.

Material identified as this species is on the basis of a series of 11 specimens labeled "Fairfield WS" which I believe are part of the lot mentioned by Casey (1911, p. 250) as received by him from Johnson. The distribution of *H. caseyi* appears to be from Colorado, north to Montana, thence west to Washington and Oregon, and south into California.

The spot pattern is rather similar to that of *H. convergens*, and most individuals would pass for that species or for *H. quinquesignata*. A large percentage of individuals show a linking of spots $\frac{1}{2}$, 1, and 3, or $\frac{1}{2}$ and 3, and an even greater percentage than in *convergens* have spots 4 and 5 joined.

The short and broad penis of this species offers a ready means of identifying male specimens. Unfortunately, no differences in the female genital organs have been noted for species of this group.

Two hibernating lots of *H. caseyi* were collected and submitted for examination by Maj. W. L. Jellison. There was a mass of about 900 specimens taken on August 5, 1944, on Blue Nose Peak, Lemhi County, Idaho. The other was a smaller lot of about 250 found on Deer Mountain, Ravalli County, Mont., August 27 of the same year. In these lots the specimens showing a linkage of spots $\frac{1}{2}$ and 3 were nearly half of the total. Those showing linkage of spots 4 and 5 were comparatively few.

HIPPODAMIA OREGONENSIS Crotch

FIGS. 23, 46, 170-176, 242

Hippodamia oregonensis CROUCH, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 367; Casey, 1899, Journ. New York Ent. Soc., vol. 7, p. 81; Leng, 1903, loc. cit., vol. 11, p. 42; Korschefsky, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 343.

Hippodamia dispar CASEY, 1899, Journ. New York Ent. Soc., vol. 7, p. 79.

Hippodamia puncticollis CASEY, 1899, loc. cit., vol. 7, p. 78.

Hippodamia quinquesignata ab. *puncticollis* KORSCHÉFSKY, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 344.

Hippodamia liliputana CASEY, 1908, Can. Ent., vol. 40, p. 397.

Hippodamia liliputana CASEY, 1910, Can. Ent., vol. 42, p. 109 (emendation of *liliputana*).

Hippodamia quinquesignata ab. *liliputana* KORSCHÉFSKY, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 344.

Hippodamia cockerelli JOHNSON, 1910, Carnegie Inst. Washington, Publ. 122, p. 49; Timberlake, 1919, Journ. New York Ent. Soc., vol. 27, p. 167.

This species is rare in collections and all specimens studied by me are either from Colorado or from the Pacific Northwest. I have seen in all 31 specimens, 3 in the Casey collection, 3 in the Dobzhansky collection, and 25 in the main collection of the National Museum. Twelve are from Washington State or British Columbia and the rest from various localities in Colorado.

In this species the white discal markings on the pronotum are usually absent, but in occasional specimens they are represented by minute white points. Since in the Colorado series every specimen, except the type of *cockerelli* Johnson, has the spot 6 reduced or absent and in the Washington-British Columbia series all specimens have this spot strongly developed, I have accepted these lots as representing two subspecies.

For the present I am accepting *Hippodamia cockerelli* Johnson as representing a third subspecies of *H. oregonensis*. Only the type specimen is available to me for study, and there have been reported but two other specimens. It is obvious that no conclusions drawn from such a small series can be final.

HIPPODAMIA O. OREGONENSIS Crotch

Type locality.—Oregon.

There is very little variation in the series before me. Spots $\frac{1}{2}$, 1, and 3 are always united to form a transverse basal band, spot 2 is always absent, spots 4 and 5 always joined, spot 6 usually free but occasionally joined to 4. The specimens in the collection are from Mount Yakima and the Olympic Mountains of Washington and from Mount Todd, British Columbia.

HIPPODAMIA O. DISPAR Casey

Type locality.—Colorado.

As in the preceding subspecies, spots $\frac{1}{2}$, 1, and 3 are always joined, and spot 2 is always absent. Usually spots 4 and 5 are joined, but occasionally the single spot is so small as to suggest the complete

absence of spot 4. Spot 6 is present as a small black point on 5 of the 16 specimens.

The available material is from Silverton (9 specimens), Gothic (2 specimens), Delta County (2 specimens), above Ouray (1 specimen), and Leavenworth Valley (1 specimen). The remaining specimen is from Colorado with no further data.

HIPPODAMIA O. COCKERELLI Johnson

Type locality.—Sangre de Cristo Range, Saguache County, Colo.

This subspecies (if future collections indicate that it deserves subspecific rank) is distinguished from the other subspecies by the complete linkage of all spots, number 2 being absent as usual in this species.

The type is the only specimen of this form that is available to me for study. Johnson reports two other specimens; they are from Yellowstone Park, Wyo., and are now in the Bowditch collection.

GROUP V—SINUATA

Hippodamia sinuata Muls. is withdrawn from its association with the species of the convergens group to form a fifth group in the genus. Here the penis is very broad and flat, widest at about apical third where the sides are sharply angulate and the apex is submucronate. Each paramere is relatively large, surpassing the apex of the penis by from one-third to one-fourth of its length. The elytral spots are frequently linked to form longitudinal vittae. Nearly a thousand specimens have been examined in the course of this study.

For the present I am considering this group to consist of a single species which breaks up into five subspecies and which ranges from Alaska into Mexico and east to Iowa.

The present species is one of the most interesting of the genus from the standpoint of its variability and the problems of speciation presented. More material from known ecological habitats will be necessary in order to complete the picture, but for the present certain facts may be noted. The shape of the penis seems to vary somewhat as in the species *H. glacialis* (F.). Generally, from north to south in its range, the slender apical portion of the penis becomes more elongate and this character is associated with a strengthening of the lateral angles of the penis. The northern type is found among specimens taken along the coast down into California as far as Martinez, while the southern form is projected into the north inland as far as Colorado. The differences are not clean-cut in the middle area, and many intergrading specimens are found.

In a series of 15 specimens of *H. sinuata disjuncta* Timb. collected at Loveland, Colo., June 26, 1935, by Th. Dobzhansky, there was a single male specimen with deformed genitalia (fig. 28) of a peculiar and interesting type. The acetabula for the attachment of the parameres, normally lateral, are situated dorsally, and the parameres, normally capable of independent movement, are joined rigidly by a yoke across their bases so that they are required to move together and only in the vertical plane. Further, the penis carries a transverse crest reminiscent of that in *H. quinquesignata* (Kby.).

HIPPODAMIA SINUATA Mulsant

FIGS. 25-26, 28, 41, 43, 195-226, 244-245

- Hippodamia sinuata* MULSANT, 1850, Species Coléopt. Trim. Sécuripalpes, p. 1011; Crotch, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 365; 1874, Revision Coccinellidae, p. 96; Casey, 1899, Journ. New York Ent. Soc., vol. 7, p. 81; Leng, 1903, loc. cit., vol. 11, p. 40, pl. 4; Casey, 1908, Can. Ent., vol. 40, p. 398; Johnson, 1910, Carnegie Inst. Washington, Publ. 122, p. 50, fig. 35; Timberlake, 1919, Journ. New York Ent. Soc., vol. 27, p. 167; Korschefsky, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 344.
- Hippodamia spuria* LECONTE, 1861, Proc. Acad. Nat. Sci. Philadelphia, vol. 13, p. 358; Mulsant, 1866, Monogr. Coccinellides, pt. I, p. 15; Crotch, 1873, Trans. Amer. Ent. Soc., vol. 4, p. 365; 1874, Revision Coccinellidae, p. 96; Casey, 1899, Journ. New York Ent. Soc., vol. 7, p. 80; Leng, 1903, loc. cit., vol. 11, p. 42, pl. 4; Casey, 1908, Can. Ent., vol. 40, p. 399; Johnson, 1910, Carnegie Inst. Washington, Publ. 122, p. 46, figs. 29-31; Timberlake, 1919, Journ. New York Ent. Soc., vol. 27, p. 168; Korschefsky, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 345.
- Hippodamia trivittata* CASEY, 1899, Journ. New York Ent. Soc., vol. 7, p. 80; Korschefsky, 1932, Junk-Schenkling, Coleopt. Catalogus, pars 120, Coccinellidae II, p. 345. (= *sinuata* Muls.)
- Hippodamia crotchi* CASEY, 1899, Journ. New York Ent. Soc., vol. 7, p. 80; 1908, Can. Ent., vol. 40, p. 399.
- Hippodamia complex* CASEY, 1899, Journ. New York Ent. Soc., vol. 7, p. 80. (= *spuria* Lec.)
- Hippodamia sinuata disjuncta* TIMBERLAKE, 1919, Journ. New York Ent. Soc., vol. 27, p. 169.
- Hippodamia americana fontinalis* CASEY, 1924, Mem. Coleopt., vol. 11, p. 156. (= *crotchi* Csy.)

HIPPODAMIA SIN. SINUATA Mulsant

Type locality.—California.

The spot pattern is rather difficult of interpretation. Spot $\frac{1}{2}$ is continued along the suture from the scutellum nearly to the apex and in some specimens appears to involve spot 3. Other specimens show no expansion at basal fourth of the suture that can be considered as

spot 3; therefore I consider spot 3 as unstable and often absent. Spot 2 seems always to be absent. Each elytron bears a broad longitudinal vitta composed of spots 1, 5, 4, and 6.

The range of this subspecies is from the San Francisco Bay region south into Mexico (Durango).

HIPPODAMIA SIN. CROTCHI Casey

Type locality.—Lake County, Calif.

At first glance hardly more than a variety of *H. sin. sinuata*, but as the form is restricted in its distribution it seems best to treat it as a subspecies.

Typically, the spot pattern is as follows: Spots $\frac{1}{2}$ and 3 joined to form a single sutural spot covering about basal fourth of suture; spot 2 absent; spots 1, 5, and 4 joined to form an inverted Y with long stem and short arms; spot 6 isolated and always (?) present.

This is the dominant form in New Mexico and Arizona. It appears in Lake County, Calif., a locality on the periphery of the distribution of *H. sin. sinuata*. Inland and to the north it is frequently met with in Colorado, Utah, and Wyoming, there mixed with *H. sin. disjuncta*.

HIPPODAMIA SIN. DISJUNCTA Timberlake

Type locality.—Utah (Salt Lake and Murray).

In this and the following subspecies, there is a complete separation of spots 1 and 5. In the case of *H. sin. disjuncta*, spot 2 (as in all subspecies of *H. sinuata*) is missing, spot 3 often missing but occasionally spot $\frac{1}{2}$ is extended along the suture and widened at basal fourth of suture to suggest presence of this spot, spots 4, 5, and 6 usually isolated, 4 and 5 frequently joined, 4, 5, and 6 rarely joined. Pigmentation light as compared with *H. sin. spuria*.

The dominant form in Utah, Wyoming, Idaho, and eastern Oregon and eastern Washington. Frequently seen in collections from Colorado and northern California.

HIPPODAMIA SIN. SPURIA Leconte

Type locality.—Oregon.

Through the kindness of Dr. P. J. Darlington, the type of *H. spuria* Leconte has been compared with Oregon specimens and its identity with the heavily pigmented form is established.

This subspecies is the heavily pigmented counterpart of *H. sin. disjuncta*. The arrangement and linkage of spots is the same in the two forms except that spot 3 is almost always evident as a posterior

expansion of spot $\frac{1}{2}$ and very rarely there is a trace of linkage between spots $\frac{1}{2}$ and 3 and spot 5. Linkages involving spots 4, 5, and 6 are more frequent here.

This is the West Coast form and is apparently confined to the area west of the coast range from British Columbia south to Port Angeles, Wash.

HIPPODAMIA SIN. STRAMINEA, new subspecies

Type locality.—Klamath River, Calif.

Type (male) and paratypes (both sexes), U.S.N.M. No. 57893. Paratypes in collections of Th. Dobzhansky, F. T. Scott, G. H. Dieke, J. E. Blum, and G. P. Mackenzie.

The Dobzhansky collection contains a series of 25 specimens from the Klamath River area (Klamath River, Klamath Glen, and Fortuna), of which 20 are without trace of spots on the elytra except for the very feeble development of spot $\frac{1}{2}$. The remaining five are very lightly to lightly pigmented. The lot is suggestive of the collection of *H. lunatomaculata* Mots. made by the same author at Willows, Calif. In the absence of adequate evidence to the contrary I am treating this lot as an interesting but highly restricted subspecies.

GROUP VI—KOEBELEI

This group contains the single aberrant species *H. koebelei* Timberlake, recently described from Mexico. It is similar in body form and general appearance to *H. convergens* Guérin of Group IV. It is however distinct from all other known species of the genus in that the first segments of the front and middle tarsi of the male are broadly dilated. The third antennal segment is simple and not triangularly expanded as in other genera of the Hippodamiini which have dilated tarsal segments. Further, the male genitalia are quite distinct, having the following peculiarities: Each paramere has the dorsal internal edge margined by a membranous lobe; a lesser but similar lobe is along the ventral internal edge. The ventral alae are connected apically with the penis by a loose membranous area. The tip of the siphon bears two lateral processes which are cylindrical and terminate in bladderlike structures and are situated on either side of the median line above and between the flaps which are lateral.

HIPPODAMIA KOEBELEI Timberlake

FIGS. 27, 44, 167-169, 246

Hippodamia koebelei TIMBERLAKE, 1942, Proc. Ent. Soc. Washington, vol. 44, p. 39; 1943, Hawaiian Planter's Record, vol. 47, p. 11; Bull. Exp. Sta.

Hawaiian Sugar Planters Association, Ent. Ser., Bull. 22, p. 11 (reprint of above, without change of pagination).

Type locality.—Mexico City, Mexico.

Except for the differences in tarsal structure and genitalia of male noted above, individuals of this species can hardly be distinguished from immaculate specimens of *H. convergens* Guérin. Usually the pronotal markings in *H. koebelei* are more finely drawn and even throughout. The emargination of the fifth visible sternite of the male is wider and deeper in *H. koebelei* than in *H. convergens*, a condition coordinated with the relatively greater size of the genitalia in the former.

In addition to a portion of the type material, more than 50 specimens of this species have been examined by the writer, most of which were intercepted at quarantine along the Mexican-United States border. Exact localities for intercepted material cannot be established, but a statement in a letter of January 31, 1940, from J. B. R. Leary, Supervisor, District 2, Mexican Border, to O. D. Deputy, Supervisor, Mexican Border Service, Bureau of Entomology and Plant Quarantine, casts some light on the subject. I quote: "Inquiry in the Nuevo Laredo market, however, reveals that lettuce comes from San Luis Potosí, S. L. P. and Ramos Arispe, Coah., during the winter. In the summer it is shipped from Celaya, Gto."

Specimens from definite localities, other than those in the type series, have been seen from Amecameca, March 9, 1938, and Toluca, March 1, 1938, both State of Mexico, collected by Th. Dobzhansky. A specimen recorded in the original description as from Mexico City appears to have been taken at Puebla, State of Puebla, May 27, 1922, by E. G. Smyth.

EXPLANATION OF PLATES

PLATE I

ANATOMY OF *Hippodamia tredecim-punctata* (L.) (SPANDAU, GERMANY).
TYPE SPECIES OF *Hippodamia*, AS DESIGNATED BY CROTCH, 1873

- FIG. 1. Dorsal view, showing conventional numeration of the elytral spots.
2. Ventral view of abdomen of male.
3. Ventral view of abdomen of female.
4. Aedeagus, dorsal view. BP, basal piece; P, penis; PA, paramere; VA, ventral ala.
5. Aedeagus, lateral view (front paramere dissected away). TR, trabes.
6. Aedeagus, ventral view.
7. Siphon. SC, siphonal capsule; SF, dorsal flaps.
8. Sclerotized portion of female genital system. BC, bursa copulatrix; IN, infundibulum accessory piece; SD, sperm duct; RS, receptaculum seminis; AG, accessory gland.

PENIS AND PARAMERES

PLATE 2

- FIG. 9. *H. tr. tibialis* (Say). Jerome, Idaho, August 26, 1930, D. F. Fox.
 10. *H. americana* Crotch. Whitefish Point, Lake Superior, Mich., Hubbard and Schwarz collection.
 11. *H. falcigera* Crotch. Hudson Bay, Hubbard and Schwarz collection.
 12. *H. washingtoni* Timberlake. Hoquiam, Wash., May 1, 1903, H. E. Burke.

PLATE 3

- FIG. 13. *H. parenthesis* (Say). Adams County, Iowa, November 1936.
 14. *H. apicalis* Casey. Independence, Calif., July 11, H. F. Wickham.
 15. *H. expurgata* Casey. Salt Lake, Utah, June 13, Hubbard and Schwarz collection.
 16. *H. lunatamaculata* Motschulsky. Port Angeles, Wash., August 12, 1934, Th. Dobzhansky. (Type of *H. l. dobzhanskyi* n. subsp.).

PLATE 4

- FIG. 17. *H. glacialis* (Fabricius). Watch Hill, R. I., July 22, 1909, W. Robinson.
 18. *H. glacialis* (Fabricius). Variation in penis.
 A, B, C, Watch Hill, R. I.
 D, E, F, Rocky Ford, Colo.
 19. *H. quinquesignata* (Kirby). Duluth, Minn.
 20. *H. quindecim-maculata* Mulsant. St. Louis, Mo., September 13, 1891, H. Soltau.

PLATE 5

- FIG. 21. *H. convergens* Guérin. Barnesville, Ga., May 29, 1932, T. H. Bissell.
 22. *H. moesta* Leconte. Nanaimo, Vancouver Island, May 13, 1897, Taylor.
 23. *H. oregonensis* Crotch. Olympic Mts., Wash., August 1932, Th. Dobzhansky.
 24. *H. caseyi* Johnson. Moscow, Idaho, July 10, R. C. Shannon.

PLATE 6

- FIG. 25. *H. sinuata* Mulsant. Martinez, Calif., December 12, 1882, Turner.
 26. *H. sinuata* Mulsant. Variation in penis.
 A, Martinez, Calif., December 12, 1882, Turner.
 B, Maxwell, N. Mex., May 4, 1916, D. J. Caffrey.
 C, Puyallup, Wash., June 17, 1916, T. H. Scheffer.
 D, Greeley, Colo., July 28, 1930.
 E, Flagstaff, Ariz., July 16, B. P. Clark.
 F, Durango, Dgo., Mexico, November 1927, F. C. Bishopp.
 27. *H. koebeleri* Timberlake. Ex Mexico at Laredo, Tex., December 16, 1939, U. S. D. A. Interception Laredo No. 18648.
 28. *H. sinuata* Mulsant. Abnormal specimen from Loveland, Colo., June 26, 1935, Th. Dobzhansky.

SIPHO

PLATE 7

- FIG. 29. *H. tr. tibialis* (Say). Half Moon Bay, Calif., June 24, 1932, Th. Dobzhansky.
30. *H. americana* Crotch. Whitefish Point, Lake Superior, Mich., Hubbard and Schwarz collection.
31. *H. falcigera* Crotch. Yellowstone, Wyo., July 1935, J. E. Blum.
32. *H. expurgata* Casey. Salt Lake, Utah, June 13, Hubbard and Schwarz collection.
33. *H. washingtoni* Timberlake. Hoquiam, Wash., May 27, 1917, H. G. Dyar.
34. *H. parenthesis* (Say). West Point, N. Y., May 17, 1909, W. Robinson.
35. *H. apicalis* Casey. Paonia, Colo., June 14, 1904, E. S. G. Titus.
36. *H. lunatamaculata* Motschulsky. Corvallis, Oreg., July 22, 1931.
37. *H. quinquesignata* (Kirby). Milner, Idaho, July 20, 1929, L. B. Jones.

PLATE 8

- FIG. 38. *H. moesta* Leconte. Nanaimo, Vancouver Island, May 13, 1897, Taylor.
39. *H. caseyi* Johnson. Little Baldy Mts., Utah, 8,780 feet, May 13, 1939, Knowlton and Nye.
40. *H. g. lecontei* Mulsant. Victor, Idaho, August 7, 1939, Th. Dobzhansky.
41. *H. sinuata* Mulsant. Martinez, Calif., December 12, 1882, Turner.
42. *H. quindecim-maculata* Mulsant. Denver, Colo., August 16, 1898, E. J. Oslar.
43. *H. sinuata* Mulsant. Durango, Dgo., Mexico, November 1927, F. C. Bishopp.
44. *H. koebele* Timberlake. Ex Mexico at Laredo, Tex., January 27, 1940, U. S. D. A. Interception Laredo No. 19379.
45. *H. g. glacialis* (Fabricius). Agawam, Mass., June 27, 1916, D. A. Ricker.
46. *H. oregonensis* Crotch. Mount Yakima, Wash., 6,000 feet, September 16, 1922, E. J. Newcomer.
47. *H. convergens* Guérin. Greeley, Colo., August 4, 1930.

SPOT PATTERNS

PLATE 9

- FIG. 48. *H. tr. tibialis* (Say). Nulato, Alaska, June 14, 1916, Harrington.
49. *H. tr. tibialis* (Say). Whitefish Point, Lake Superior, Mich., Hubbard and Schwarz collection.
50. *H. tr. tibialis* (Say). Oregon, Koebele.
51. *H. tr. tibialis* (Say). Truro, Nova Scotia, October 1, 1919.
52. *H. tr. tibialis* (Say). St. John, New Brunswick, June 23, 1901, W. McIntosh.
53. *H. tr. tibialis* (Say). Aztec, N. Mex., May 5, C. F. Baker.
54. *H. tr. tibialis* (Say). Muscatine, Iowa, May 19, 1917, C. E. Smith.
55. *H. tr. tibialis* (Say). Burley, Idaho, July 24, 1931.
56. *H. americana* Crotch. Wasquesu, Saskatchewan, June 10, 1938, C. Shaw.

57. *H. americana* Crotch. Whitefish Point, Lake Superior, Mich., Hubbard and Schwarz collection.
58. *H. falcigera* Crotch. Hudson Bay, Hubbard and Schwarz collection.
59. *H. falcigera* Crotch. Edmonton, Alberta, June 15, 1920, F. S. Carr. (Type of *H. albertana* Casey.)
60. *H. falcigera* Crotch. Edmonton, Alberta, June 15, 1920.
61. *H. falcigera* Crotch. Yellowstone Park, Wyo., July 1935, J. E. Blum. (Topotype of *Ceratomegilla cottlei* Nunenmacher.)
62. *H. falcigera* Crotch. Moscow, Idaho, October 2, 1927, H. A. Walker.
63. *H. washingtoni* Timberlake. Blue Mts., Oreg., June 7, 1938, H. P. Lanchester.
64. *H. washingtoni* Timberlake. Longmire Springs, Mount Ranier, Wash., 2,700 feet, July 19, 1935, H. P. Lanchester. (Paratype.)
65. *H. washingtoni* Timberlake. Hoquiam, Wash., May 1, 1903, H. E. Burke (Hopk. U. S. 1844a).
66. *H. washingtoni* Timberlake. Hoquiam, Wash., May 1, 1903, H. E. Burke (Hopk. U. S. 1844a).
67. *H. washingtoni* Timberlake. Hoquiam, Wash., May 1, 1903, H. E. Burke (Hopk. U. S. 1844a).

PLATE 10

- FIG. 68. *H. parenthesis* (Say). Rockaway Beach, L. I., N. Y., June 20, 1904, Brooklyn Museum collection.
69. *H. parenthesis* (Say). West Point, N. Y., June 14, 1909, W. Robinson.
 70. *H. parenthesis* (Say). Glen Echo, Md., July 12, 1930, J. C. Bridwell.
 71. *H. parenthesis* (Say). Antelope Valley, Calif., May 1925, R. E. Campbell.
 72. *H. parenthesis* (Say). Proberta, Calif., June 23, 1932, Th. Dobzhansky.
 73. *H. parenthesis* (Say). Spearfish, S. Dak., August 1, 1938, Th. Dobzhansky.
 74. *H. a. apicalis* Casey. Lake Tahoe, Calif., July 12, Hubbard and Schwarz collection.
 75. *H. a. apicalis* Casey. Reno, Nev., Casey collection. (Type.)
 76. *H. a. apicalis* Casey. Truckee, Calif., Casey collection. (Paratype.)
 77. *H. a. apicalis* Casey. Klamath Agency, Oreg., June 20, 1932, Th. Dobzhansky.
 78. *H. a. apicalis* Casey. Madras, Oreg., June 19, 1932, Th. Dobzhansky.
 79. *H. a. apicalis* Casey. Maupin, Oreg., June 19, 1932, Th. Dobzhansky.
 80. *H. a. apicalis* Casey. Madras, Oreg., June 19, 1932, Th. Dobzhansky.
 81. *H. a. apicalis* Casey. Terrebonne, Oreg., June 19, 1932, Th. Dobzhansky.
 82. *H. a. apicalis* Casey. Klamath Agency, Oreg., June 20, 1932, Th. Dobzhansky.
 83. *H. a. lengi* Johnson. San Diego County, Calif., Coquillett. (Paratype.)
 84. *H. a. lengi* Johnson. Near Jacumba, San Diego County, Calif., H. Morrison.
 85. *H. a. lengi* Johnson. Near Jacumba, San Diego County, Calif., H. Morrison.

86. *H. a. lengi* Johnson. Near Jacumba, San Diego County, Calif., H. Morrison.
 87. *H. lunatamaculata* Motschulsky. Original figure from Bull. Acad. Nat. Sci., Moscow, vol. 18, pl. 7, fig. 8, 1845. (Enlarged.)

PLATE II

- FIG. 88. *H. expurgata* Casey. Bright Angel, Grand Canyon, Ariz., July 10, Barber and Schwarz collection.
 89. *H. expurgata* Casey. Prescott, Ariz., July 20, Barber and Schwarz collection.
 90. *H. expurgata* Casey. Williams, Ariz., May 30, Barber and Schwarz collection.
 91. *H. expurgata* Casey. Wasatch, Utah, June 27, Hubbard and Schwarz collection.
 92. *H. expurgata* Casey. Bright Angel, Grand Canyon, Ariz., November 7, Barber and Schwarz collection.
 93. *H. expurgata* Casey. Fort Robinson, Nebr., July 30, 1935, Th. Dobzhansky.
 94. *H. expurgata* Casey. Boulder, Colo., Casey collection. (Paratype.)
 95. *H. expurgata* Casey. Boulder, Colo., Casey collection. (Type.)
 96. *H. expurgata* Casey. Ucross, Wyo., August 2, 1935, Th. Dobzhansky.
 97. *H. l. dobzhanskyi*, new subspecies. Willamette Valley, Oreg., February 5, 1931, A. O. Larson.
 98. *H. l. dobzhanskyi*, new subspecies. Oregon, Koebele.
 99. *H. l. dobzhanskyi*, new subspecies. Oregon, Koebele.
 100. *H. l. dobzhanskyi*, new subspecies. Port Angeles, Wash., August 12, 1934, Th. Dobzhansky. (Type.)
 101. *H. l. dobzhanskyi*, new subspecies. Port Angeles, Wash., August 12, 1934, Th. Dobzhansky. (Paratype.)
 102. *H. l. lunatamaculata* Motschulsky. Half Moon Bay, Calif., Scott.
 103. *H. l. lunatamaculata* Motschulsky. Willows, Calif., June 23, 1932, Th. Dobzhansky.
 104. *H. l. lunatamaculata* Motschulsky. Willows, Calif., June 23, 1932, Th. Dobzhansky.
 105. *H. l. lunatamaculata* Motschulsky. Willows, Calif., June 23, 1932, Th. Dobzhansky.
 106. *H. l. lunatamaculata* Motschulsky. Willows, Calif., June 23, 1932, Th. Dobzhansky.

PLATE 12

- FIG. 107. *H. g. glacialis* (Fabricius). Springfield, Mass., Geo. Dimmock.
 108. *H. g. glacialis* (Fabricius). Orange, N. J., H. Soltau.
 109. *H. g. glacialis* (Fabricius). Riverhead, L. I., N. Y., July 15, 1912, Russell.
 110. *H. g. glacialis* (Fabricius). "Texas," C. V. Riley collection.
 111. *H. g. glacialis* (Fabricius). Vienna, Va., August 25, 1911, C. W. Hooker.

112. *H. g. glacialis* (Fabricius). Ipswich, Mass., August 1922, D. H. Blake.
113. *H. g. glacialis* (Fabricius). Boulder, Colo., Casey collection. (Type of *abducens* Casey.)
114. *H. g. glacialis* (Fabricius). "Montana," C. V. Riley collection.
115. *H. g. extensa* Mulsant. Alameda County, Calif., J. E. Blum.
116. *H. g. extensa* Mulsant. Alameda County, Calif., J. E. Blum.
117. *H. g. lecontei* Mulsant. Albuquerque, N. Mex., W. Robinson.
118. *H. g. lecontei* Mulsant. Seligman, Ariz., H. F. Wickham.
119. *H. g. lecontei* Mulsant. Seligman, Ariz., H. F. Wickham.
120. *H. g. lecontei* Mulsant. Albuquerque, N. Mex., W. Robinson.
121. *H. g. lecontei* Mulsant. Seligman, Ariz., H. F. Wickham.
122. *H. g. mackenziei*, new subspecies. Glacier Lodge, Inyo County, Calif., August 2, 1942, Mackenzie. (Paratype.)
123. *H. g. mackenziei*, new subspecies. Glacier Lodge, Inyo County, Calif., August 3, 1942, Mackenzie. (Type.)
124. *H. g. mackenziei*, new subspecies. Glacier Lodge, Inyo County, Calif., August 4, 1942, Mackenzie. (Paratype.)
125. *H. g. mackenziei*, new subspecies. Glacier Lodge, Inyo County, Calif., August 3, 1942, Mackenzie. (Paratype.)
126. *H. g. mackenziei*, new subspecies. Glacier Lodge, Inyo County, Calif., August 3, 1942, Mackenzie. (Paratype.)

PLATE 13

- FIG. 127. *H. q. quinquesignata* (Kirby). Bear Lake, British Columbia, July 21, 1903, R. P. Currie.
128. *H. q. quinquesignata* (Kirby). Whitefish Point, Lake Superior, Mich., Hubbard and Schwarz collection.
129. *H. q. quinquesignata* (Kirby). Locality unknown, Levette collection. (Type of *H. subsimilis* Casey.)
130. *H. q. quinquesignata* (Kirby). Green River, Wyo., Casey collection. (Type of *H. vernix* Casey.)
131. *H. q. quinquesignata* (Kirby). Boulder, Colo., Casey collection. (Type of *H. coccinea* Casey.)
132. *H. q. quinquesignata* (Kirby). Sevier Lake, Utah, July, Wickham. (Type of *H. uteana* Casey.)
133. *H. q. quinquesignata* (Kirby). Edmonton, Alberta, June 7, 1919, F. S. Carr, Casey collection. (Type of *H. quadraria* Casey.)
134. *H. q. quinquesignata* (Kirby). Fairfield, Wash., Casey collection. (Type of *H. c. pugetana* Casey.)
135. *H. q. quinquesignata* (Kirby). Kaslo, British Columbia, July 2, 1903, R. P. Currie.
136. *H. q. quinquesignata* (Kirby). Santa Rosa, Calif., Casey collection. (Type of *H. obliqua* Casey.)
137. *H. q. ambigua* Leconte. Willamette, Oreg., February 5, 1931, A. O. Larson.
138. *H. q. ambigua* Leconte. Willamette, Oreg., February 5, 1931, A. O. Larson.

139. *H. q. ambigua* Leconte. Willamette, Oreg., February 5, 1931, A. O. Larson.
 140. *H. q. ambigua* Leconte. Willamette, Oreg., February 5, 1931, A. O. Larson.
 141. *H. q. ambigua* Leconte. Willamette, Oreg., February 5, 1931, A. O. Larson.
 142. *H. q. punctulata* Leconte. Modesto, Calif., fall of 1928, A. O. Larson.
 143. *H. q. punctulata* Leconte. Modesto, Calif., fall of 1928, A. O. Larson.
 144. *H. q. punctulata* Leconte. Modesto, Calif., fall of 1928, A. O. Larson.
 145. *H. q. punctulata* Leconte. Modesto, Calif., fall of 1928, A. O. Larson.
 146. *H. q. punctulata* Leconte. Modesto, Calif., fall of 1928, A. O. Larson.

PLATE 14

- FIG. 147. *H. convergens* Guérin. Totonicapan, Guatemala, February 11, 1938, Th. Dobzhansky.
 148. *H. convergens* Guérin. Half Moon Bay, Calif., June 24, 1932, Th. Dobzhansky.
 149. *H. convergens* Guérin. Half Moon Bay, Calif., June 24, 1932, Th. Dobzhansky.
 150. *H. convergens* Guérin. Yosemite Valley, Calif., 4,000 feet, June 11, 1932, Th. Dobzhansky.
 151. *H. convergens* Guérin. California, Casey collection. (Type of *H. juncta* Casey.)
 152. *H. convergens* Guérin. Yosemite Valley, Calif., 4,000 feet, June 11, 1932, Th. Dobzhansky.
 153. *H. convergens* Guérin. Yosemite Valley, Calif., 4,000 feet, June 11, 1932, Th. Dobzhansky.
 154. *H. convergens* Guérin. Yosemite Valley, Calif., 4,000 feet, June 11, 1932, Th. Dobzhansky.
 155. *H. convergens* Guérin. San Luis Obispo, Calif., May 15, 1932, Th. Dobzhansky.
 156. *H. convergens* Guérin. Puebla, Mexico, May 29, 1932, E. G. Smythe.
 157. *H. convergens* Guérin. Yosemite Valley, Calif., 4,000 feet, June 11, 1932, Th. Dobzhansky.
 158. *H. convergens* Guérin. Yosemite Valley, Calif., 4,000 feet, June 11, 1932, Th. Dobzhansky.
 159. *H. convergens* Guérin. Yosemite Valley, Calif., 4,000 feet, June 11, 1932, Th. Dobzhansky.
 160. *H. convergens* Guérin. San Juan Mts., Colo., July 20, 1935, Th. Dobzhansky.
 161. *H. convergens* Guérin. Yosemite Valley, Calif., 4,000 feet, June 11, 1932, Th. Dobzhansky.
 162. *H. quindecim-maculata* Mulsant. St. Louis, Mo., September 13, 1891, H. Soltan collection.
 163. *H. quindecim-maculata* Mulsant. Sioux City, Iowa, September 20, 1920, C. N. Ainslie.
 164. *H. quindecim-maculata* Mulsant. Sioux City, Iowa, October 12, 1922, C. N. Ainslie.

165. *H. quindecim-maculata* Mulsant. Chelsea, Iowa, July 19, M. P. Somes.
 166. *H. quindecim-maculata* Mulsant. Batchawaung Bay, Ontario, August, Hubbard and Schwarz collection.

PLATE 15

- FIG. 167. *H. koebelci* Timberlake. Oaxaca, Mexico, September 18, L. O. Howard. (Paratype.)
 168. *H. koebelci* Timberlake. Puebla, Mexico, May 27, 1922, E. G. Smythe. (Paratype.)
 169. *H. koebelci* Timberlake. Mexico City, Mexico, May 22, 1922, E. G. Smythe. (Paratype.)
 170. *H. o. cockerelli* Johnson. Cottonwood Gulch, Saguache County, Colo., August 4, 1887, T. D. A. Cockerell. (Type.)
 171. *H. o. oregonensis* Crotch. Mount Todd, British Columbia, Hubbard and Schwarz collection.
 172. *H. o. oregonensis* Crotch. Canadian Rocky Mts., Casey collection. (Type of *H. puncticollis* Casey.)
 173. *H. o. dispar* Casey. Colorado, Casey collection. (Type of *lilliputana* Casey.)
 174. *H. o. dispar* Casey. Silverton, Colo., July 12, 1903.
 175. *H. o. dispar* Casey. Colorado, Casey collection. (Type of *H. dispar* Casey.)
 176. *H. o. dispar* Casey. Silverton, Colo., July 5, 1903.
 177. *H. m. moesta* Leconte. Seattle, Wash., S. Bethel.
 178. *H. m. moesta* Leconte. Seattle, Wash., C. V. Riley collection.
 179. *H. m. moesta* Leconte. Nanaimo, Vancouver Island, May 13, Taylor.
 180. *H. m. moesta* Leconte. Blair's Ranch, Humboldt County, Calif., June 12, 1903, H. S. Barber.
 181. *H. m. moesta* Leconte. Blair's Ranch, Humboldt County, Calif., June 9, 1903, H. S. Barber.
 182. *H. m. bowditchi* Johnson. Fort Collins, Colo., June 2, 1904, E. S. G. Titus.
 183. *H. m. bowditchi* Johnson. Kalispell, Mont., June 16-20, H. F. Wickham.
 184. *H. m. bowditchi* Johnson. Missoula, Mont., August 2, 1904.
 185. *H. m. bowditchi* Johnson. Denver, Colo., July 7, Hubbard and Schwarz collection.
 186. *H. m. politissima* Casey. Santa Cruz, Calif., Casey collection. (Type.)

PLATE 16

- FIG. 187. *H. caseyi* Johnson. Little Baldy Mts., Utah, 8,780 feet, May 13, 1939, Knowlton and Nye.
 188. *H. caseyi* Johnson. Little Baldy Mts., Utah, 8,780 feet, May 13, 1939, Knowlton and Nye.
 189. *H. caseyi* Johnson. Little Baldy Mts., Utah, 8,780 feet, May 13, 1939, Knowlton and Nye.
 190. *H. caseyi* Johnson. Little Baldy Mts., Utah, 8,780 feet, May 13, 1939, Knowlton and Nye.

191. *H. caseyi* Johnson. Mica Peak, Idaho, J. C. Merrill.
192. *H. caseyi* Johnson. Little Baldy Mts., Utah, May 13, 1939.
193. *H. caseyi* Johnson. Fairfield, Wash., Casey collection.
194. *H. caseyi* Johnson. Fairfield, Wash., Casey collection.
195. *H. sin. sinuata* Mulsant. Durango, Dgo., Mexico, H. F. Wickham.
196. *H. sin. sinuata* Mulsant. Durango, Dgo., Mexico, November 1927, F. C. Bishopp.
197. *H. sin. sinuata* Mulsant. Vine Hill, Calif., September 25, 1909, F. E. Blaisdell.
198. *H. sin. sinuata* Mulsant. Near Napa Junction, Calif. (Type of *H. trivittata* Casey.)
199. *H. sin. sinuata* Mulsant. Alameda County, Calif., October 19, 1902, E. C. Van Dyke.
200. *H. sin. sinuata* Mulsant. "California."
201. *H. sin. sinuata* Mulsant. Martinez, Calif., December, Brooklyn Museum collection.
202. *H. sin. sinuata* Mulsant. Gilroy, Calif., August 8, 1908, L. J. Condit.
203. *H. sin. disjuncta* Timberlake. Murray, Utah, May 20, 1914. (Type.)
204. *H. sin. disjuncta* Timberlake. Richfield, Utah, August 16, 1927, E. W. Davis.
205. *H. sin. disjuncta* Timberlake. Murray, Utah, August 22, 1913. (Paratype.)
206. *H. sin. disjuncta* Timberlake. Salt Lake, Utah, July 30, 1915. (Paratype.)

PLATE 17

- FIG. 207. *H. sin. spuria* Leconte. British Columbia, Casey collection. (Type of *H. complex* Casey.)
208. *H. sin. spuria* Leconte. Port Angeles, Wash., August 12, 1934, Th. Dobzhansky.
 209. *H. sin. spuria* Leconte. Nanaimo, Vancouver Island, Taylor.
 210. *H. sin. spuria* Leconte. Scio, Oreg., June 2, 1931.
 211. *H. sin. spuria* Leconte. Corvallis, Oreg., August 14, 1931.
 212. *H. sin. spuria* Leconte. Amity, Oreg., February 24, 1930, W. J. Buckhorn.
 213. *H. sin. spuria* Leconte. Amity, Oreg., February 24, 1930, W. J. Buckhorn.
 214. *H. sin. spuria* Leconte. Corvallis, Oreg., July 29, 1931.
 215. *H. sin. spuria* Leconte. Dever, Oreg., July 18, 1931.
 216. *H. sin. crotchi* Casey. Lake County, Calif., Casey collection. (Type.)
 217. *H. sin. crotchi* Casey. Jemez Springs, N. Mex., John Woodgate, Casey collection. (Type of *H. fontinalis* Casey.)
 218. *H. sin. crotchi* Casey. Cheyenne, Wyo., April 22, H. Soltau.
 219. *H. sin. crotchi* Casey. Denver, Colo.
 220. *H. sin. crotchi* Casey. Sante Fe, N. Mex., June, T. D. A. Cockerell.
 221. *H. sin. crotchi* Casey. New Mexico, Hubbard and Schwarz collection.
 222. *H. sin. crotchi* Casey. Cheyenne, Wyo., July 29, 1939, Th. Dobzhansky.
 223. *H. sin. straminea*, new subspecies. Klamath River, Calif., August 5, 1939, Th. Dobzhansky. (Paratype.)

224. *H. sin. straminea*, new subspecies. Klamath River, Calif., August 5, 1939, Th. Dobzhansky. (Paratype.)
 225. *H. sin. straminea*, new subspecies. Klamath River, Calif., Th. Dobzhansky. (Type.)
 226. *H. sin. straminea*, new subspecies. Klamath River, Calif., Th. Dobzhansky. (Paratype.)

GEOGRAPHICAL DISTRIBUTION

PLATE 18

- FIG. 227. *H. tr. tibialis* (Say).
 228. *H. americana* Crotch.
 229. *H. falcigera* Crotch.
 230. *H. washingtoni* Timberlake.

PLATE 19

- FIG. 231. *H. parenthesis* (Say).
 232. *H. apicalis* Casey.
 233. *H. expurgata* Casey.
 234. *H. lunatomaculata* Motschulsky.

PLATE 20

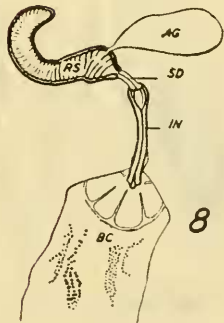
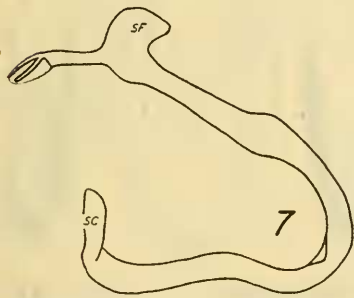
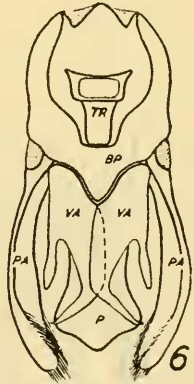
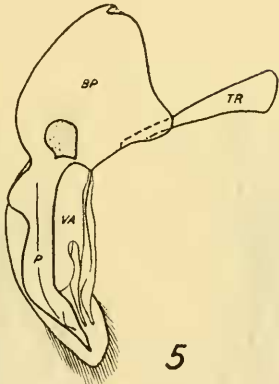
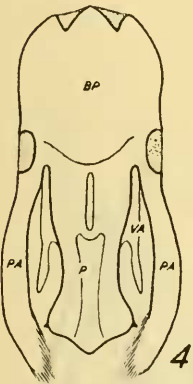
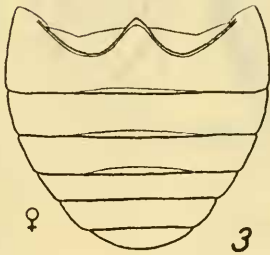
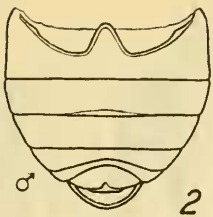
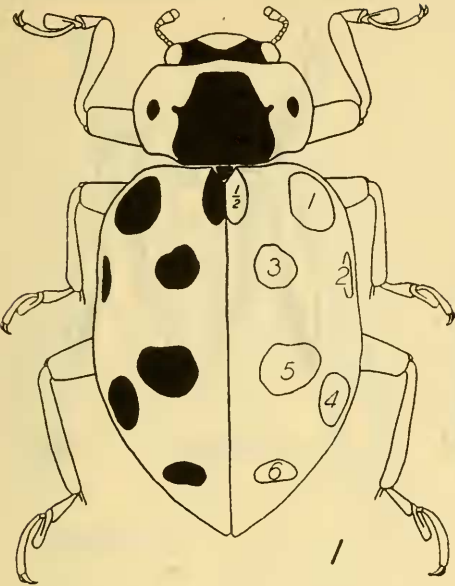
- FIG. 235. *H. glacialis* (Fabricius).
 236. *H. glacialis* (Fabricius).
 237. *H. quinquesignata* (Kirby).
 238. *H. quindecim-maculata* Mulsant.

PLATE 21

- FIG. 239. *H. convergens* Guérin. (United States.)
 240. *H. convergens* Guérin. (Mexico and Central America.)
 241. *H. moesta* Leconte.
 242. *H. oregonensis* Crotch.

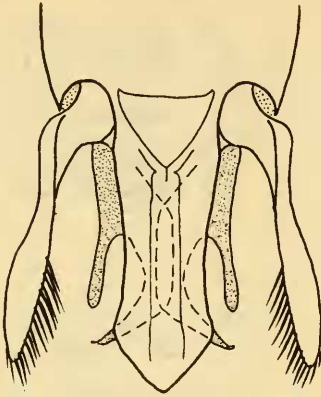
PLATE 22

- FIG. 243. *H. caseyi* Johnson.
 244. *H. sinuata* Mulsant.
 245. *H. sinuata* Mulsant.
 246. *H. koebeleii* Timberlake.



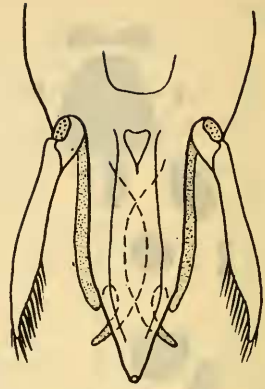
HIPPODAMIA

(For explanation, see p. 30.)



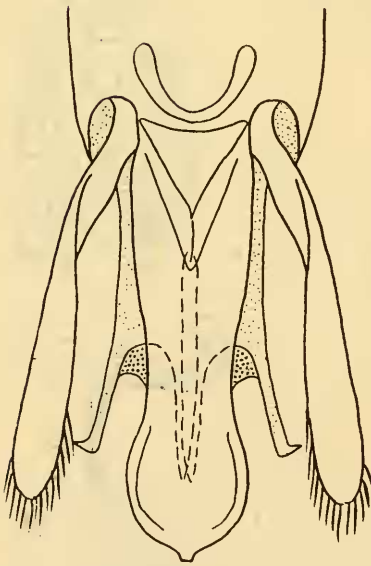
TIBIALIS

9



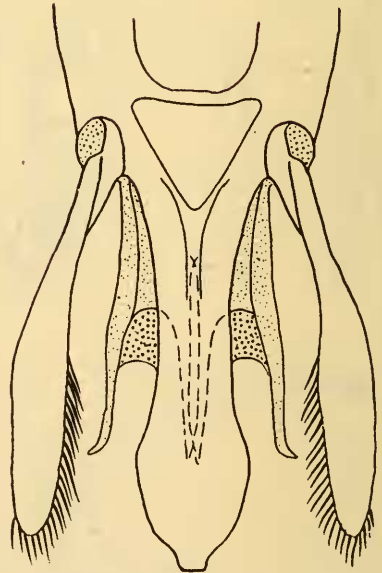
AMERICANA

10



FALCIGERA

11

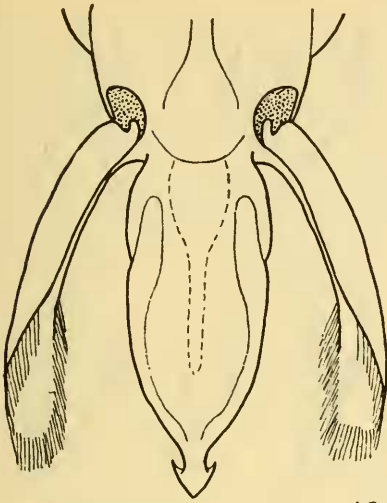


WASHINGTONI

12

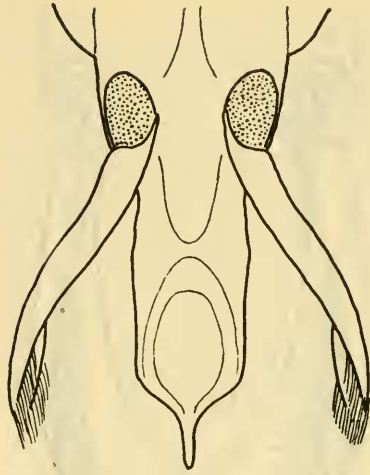
HIPPODAMIA

(For explanation, see p. 31.)



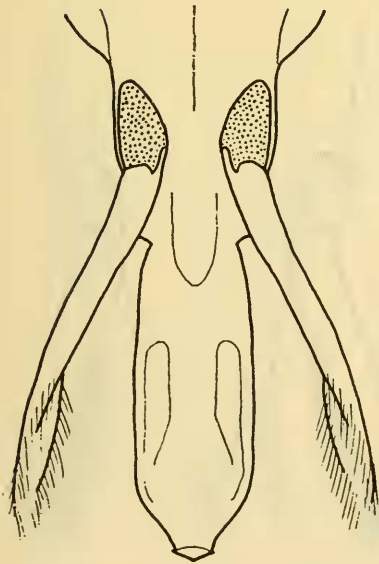
PARENTHESIS

13



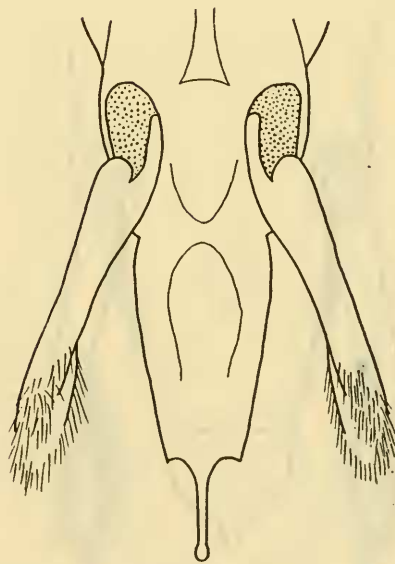
APICALIS

14



EXPURGATA

15

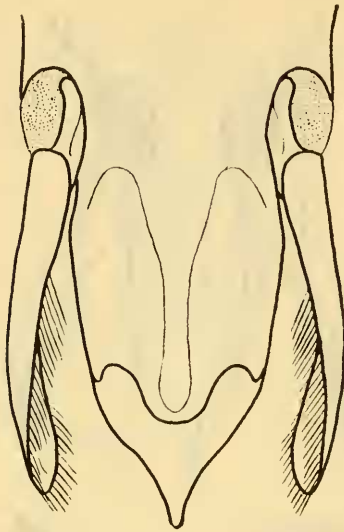


LUNATOMACULATA

16

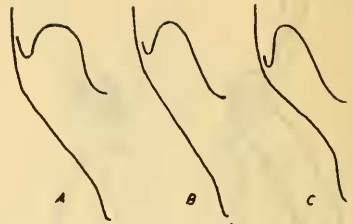
HIPPODAMIA

(For explanation, see p. 31.)



GLACIALIS

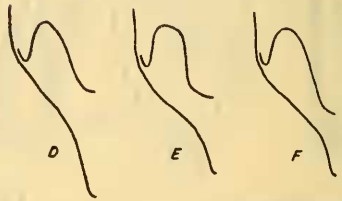
17



A

B

C



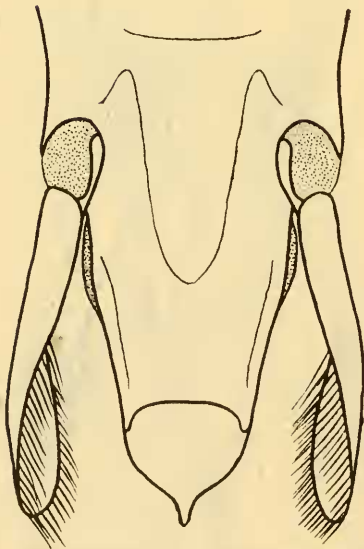
D

E

F

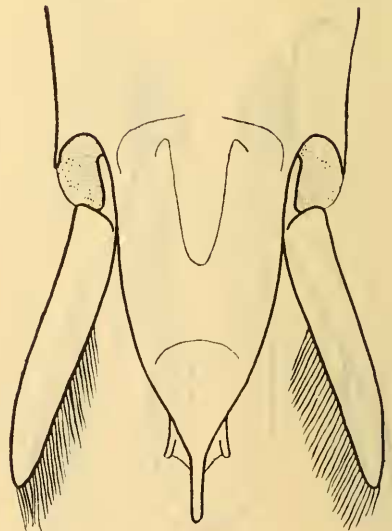
GLACIALIS

18



QUINQUESIGNATA

19

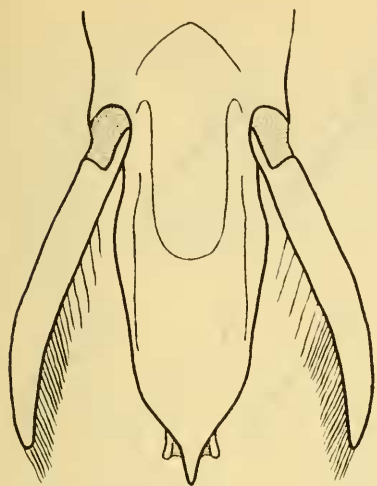


QUINDECIMMACULATA

20

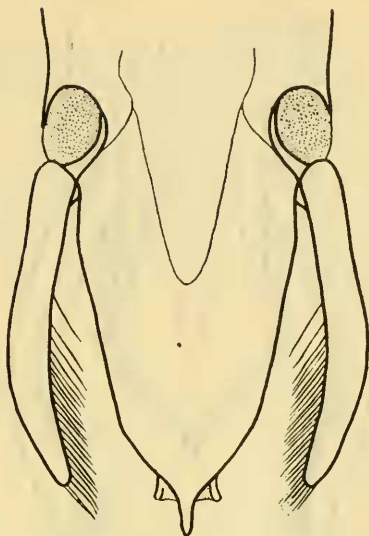
HIPPODAMIA

(For explanation, see p. 31.)



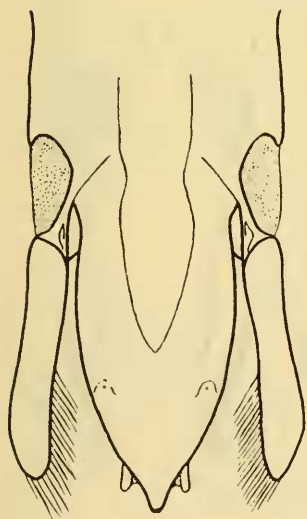
CONVERGENS

21



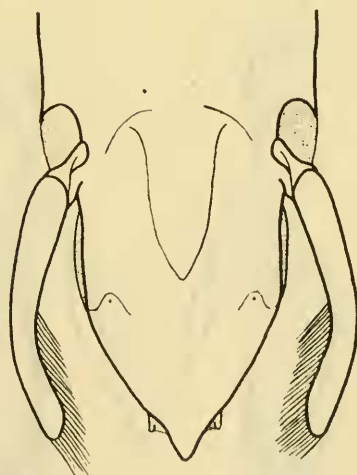
MOESTA

22



OREGONENSIS

23

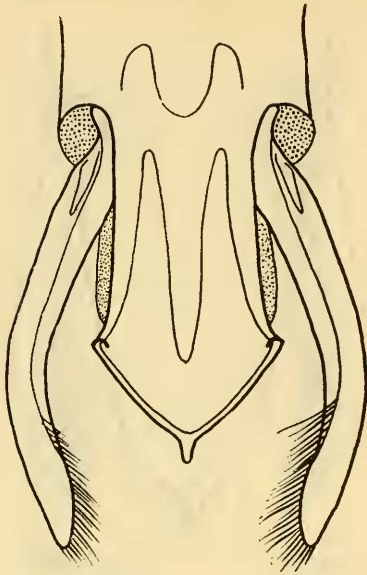


CASEYI

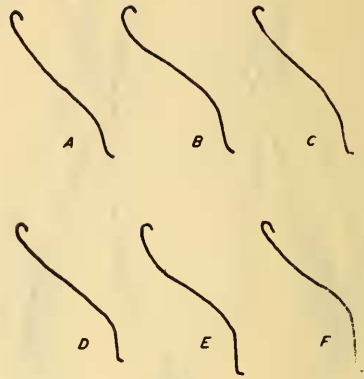
24

HIPPODAMIA

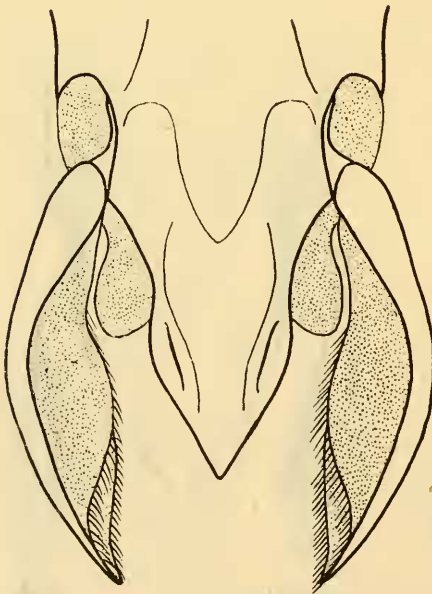
(For explanation, see p. 31.)



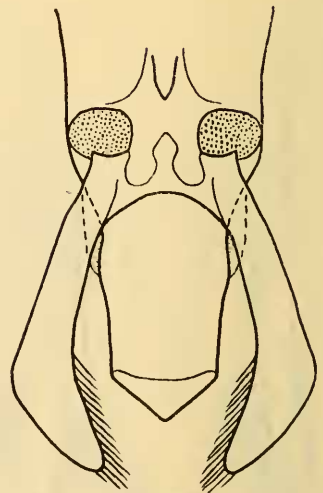
SINUATA 25



SINUATA 26



KOEBELEI 27



ABNORMALITY 28

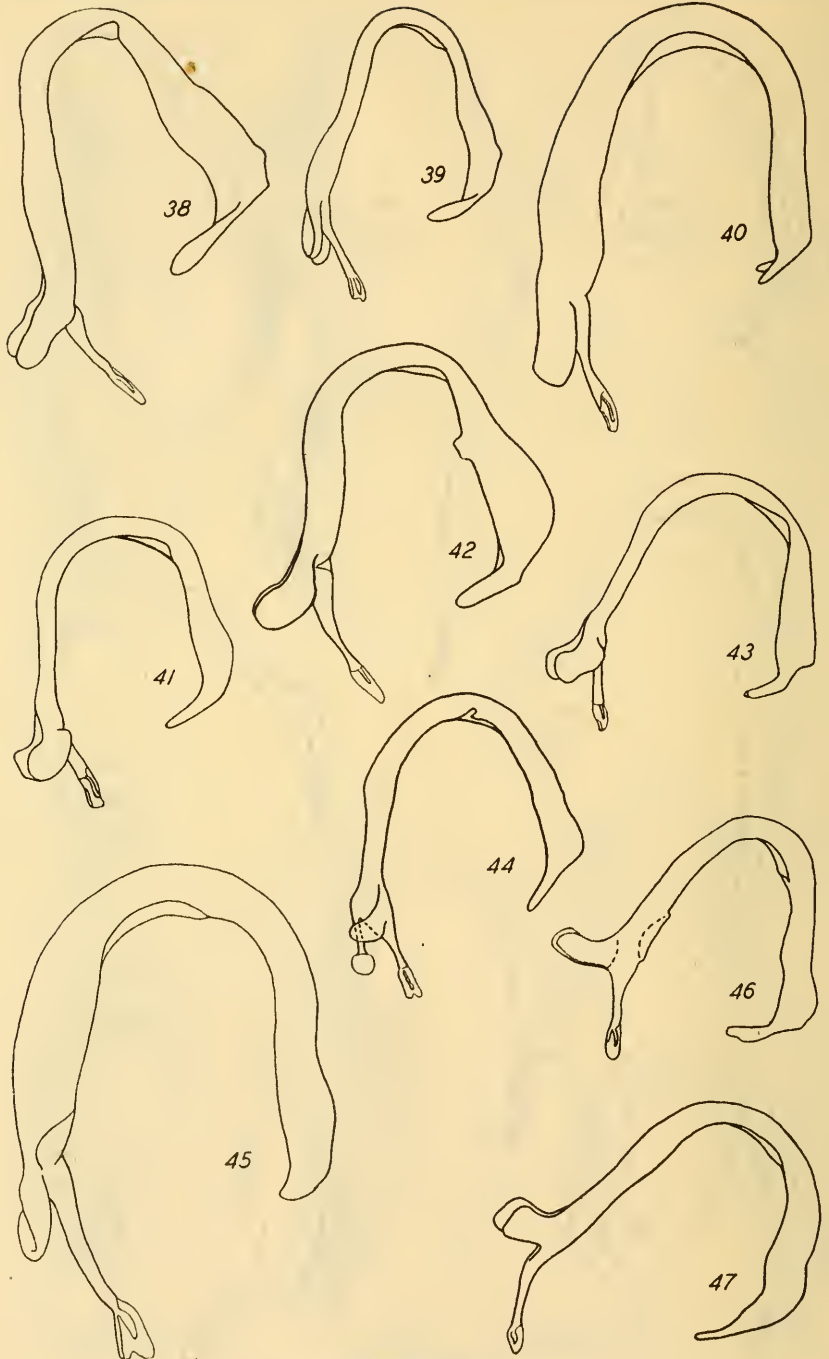
HIPPODAMIA

(For explanation, see p. 31.)



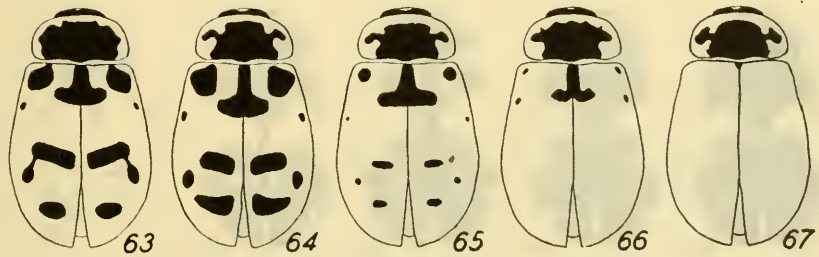
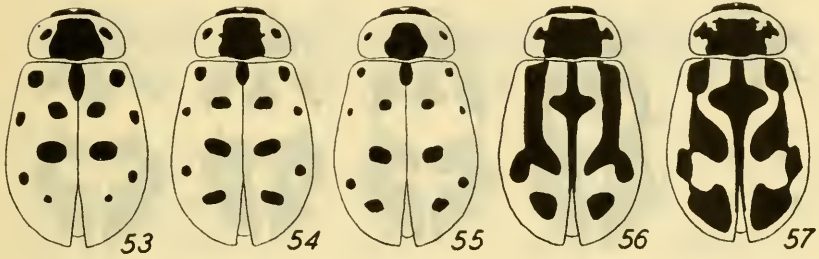
HIPPODAMIA

(For explanation, see p. 32.)



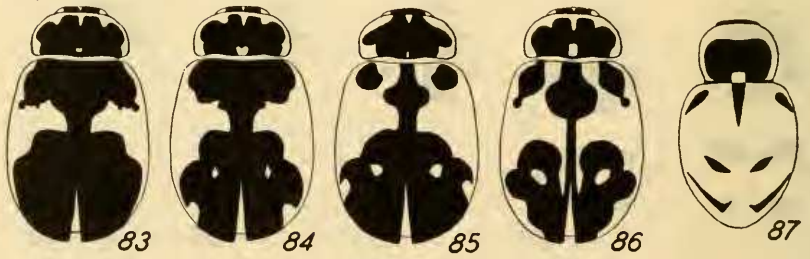
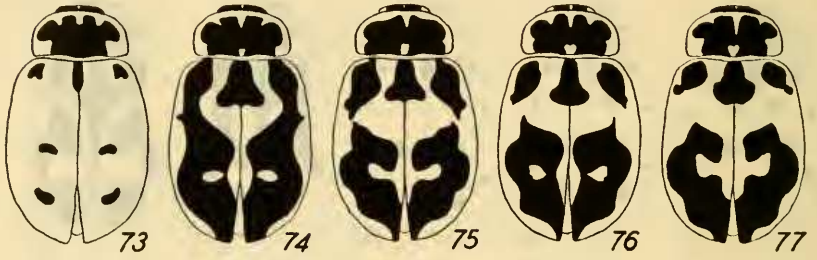
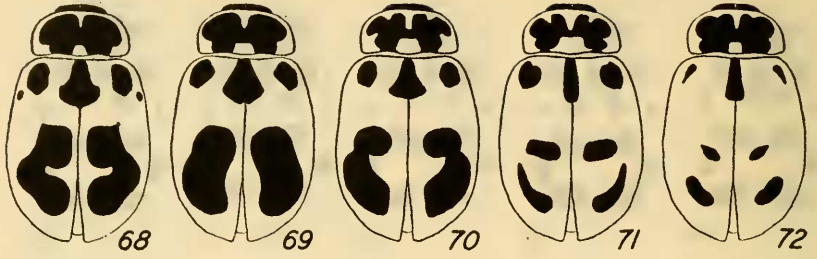
HIPPODAMIA

(For explanation, see p. 32.)



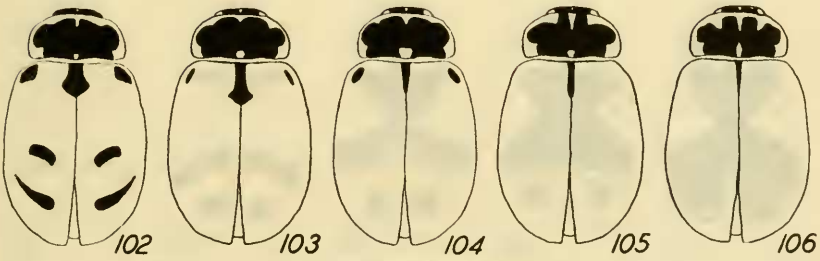
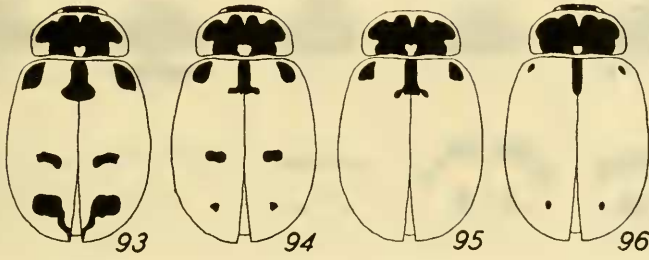
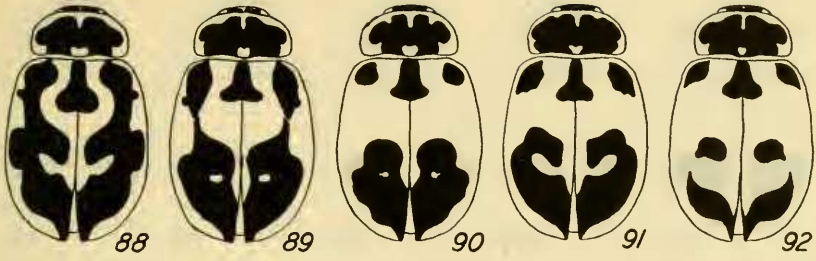
HIPPODAMIA

(For explanation, see pp. 32-33.)



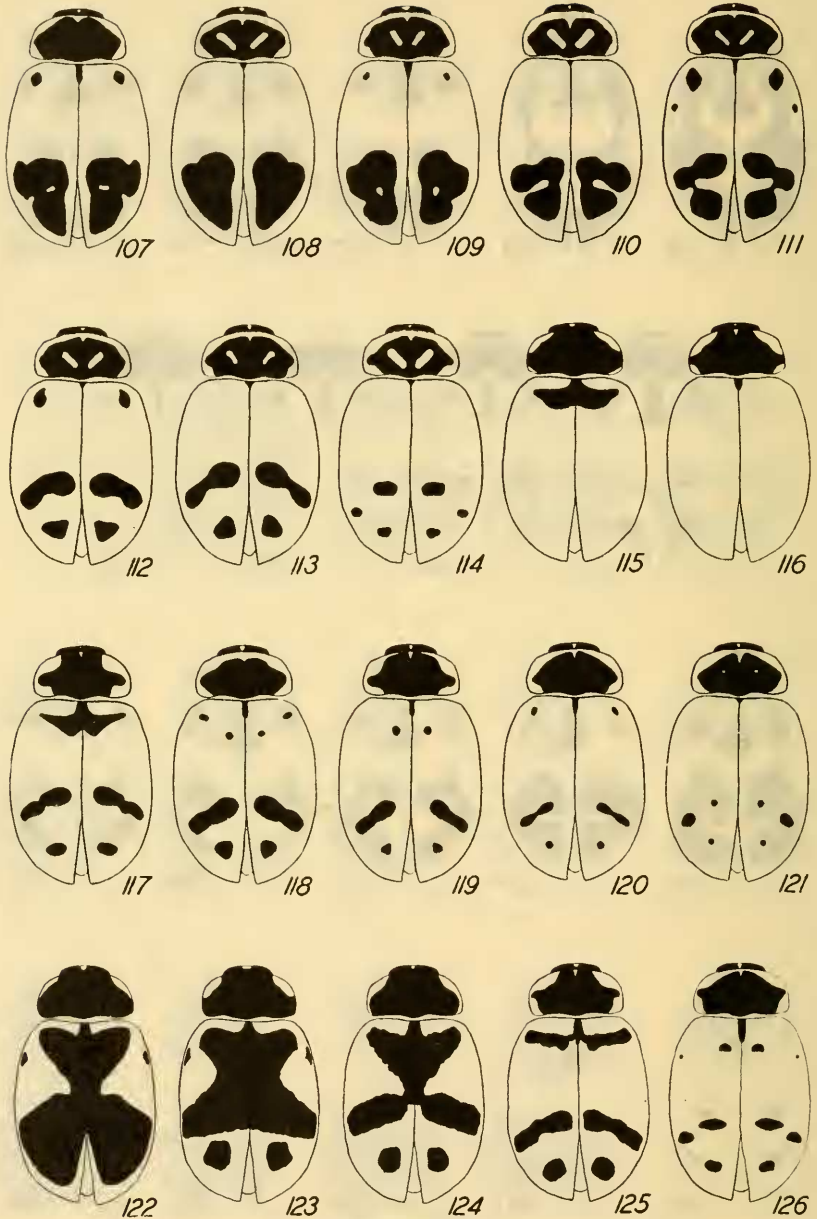
HIPPODAMIA

(For explanation, see pp. 33-34.)



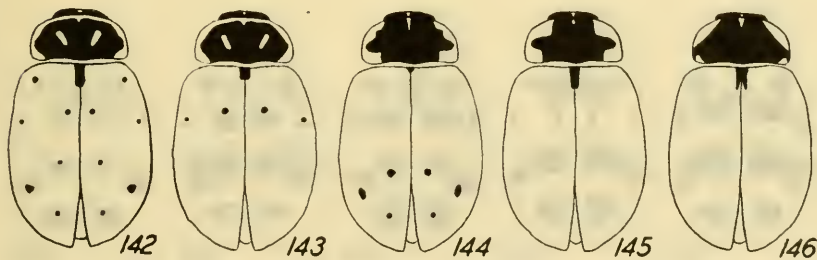
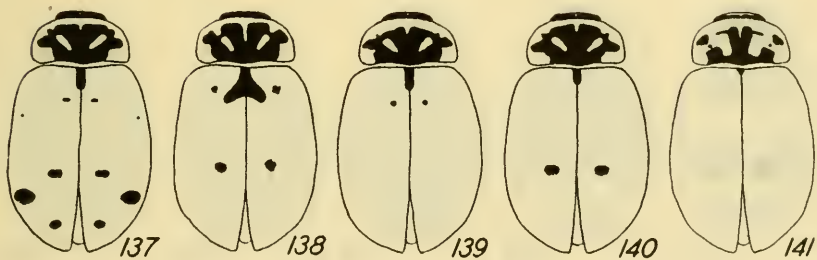
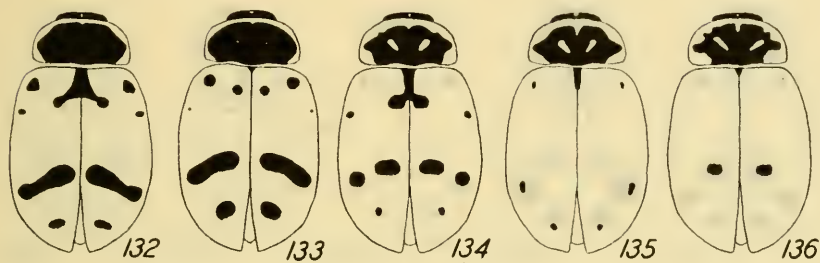
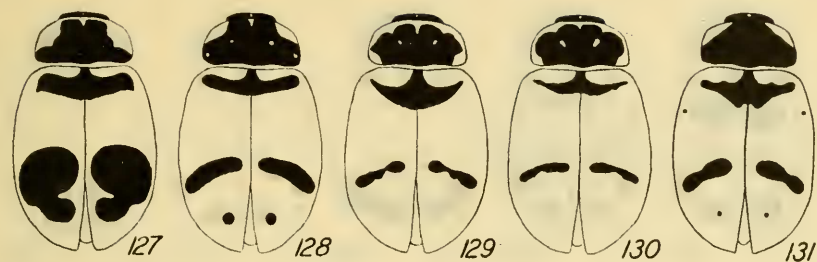
HIPPODAMIA

(For explanation, see p. 34.)



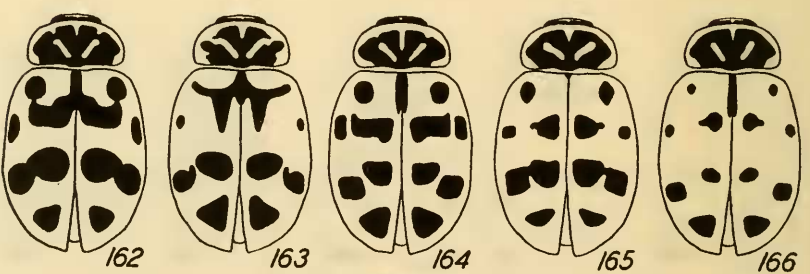
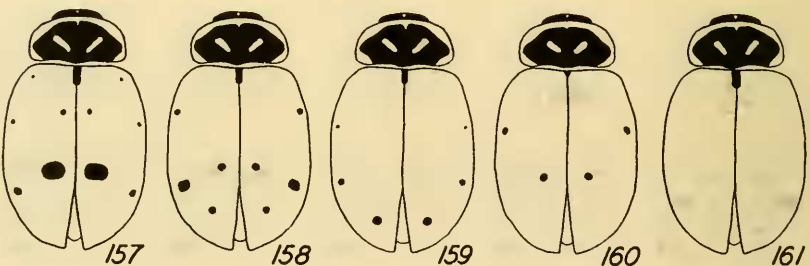
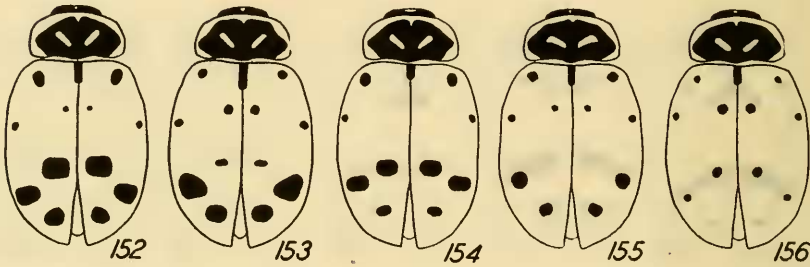
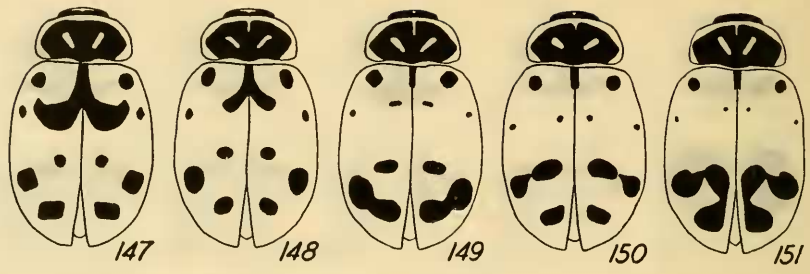
HIPPODAMIA

(For explanation, see pp. 34-35.)



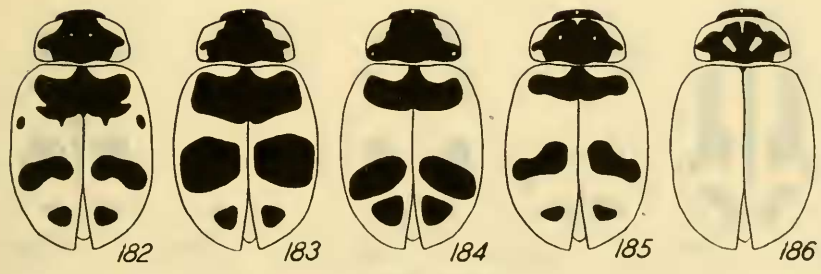
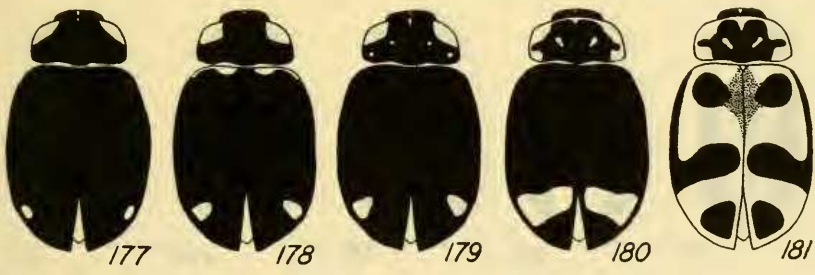
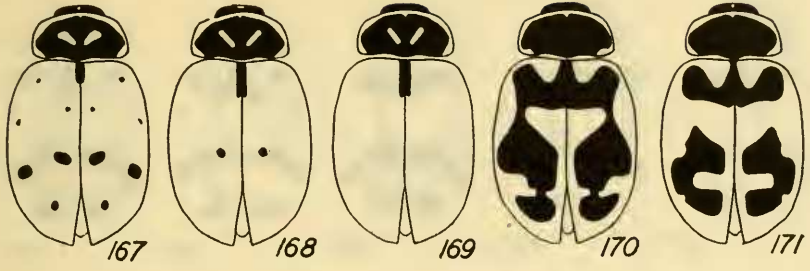
HIPPODAMIA

(For explanation, see pp. 35-36.)



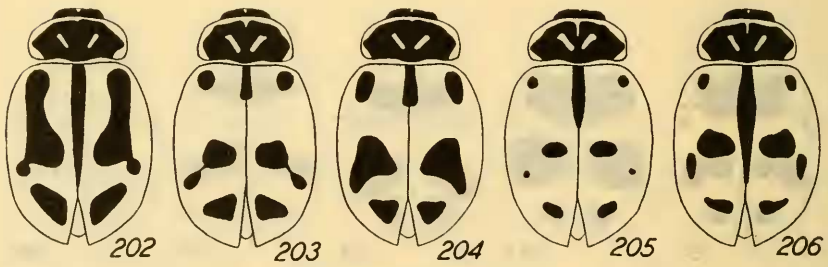
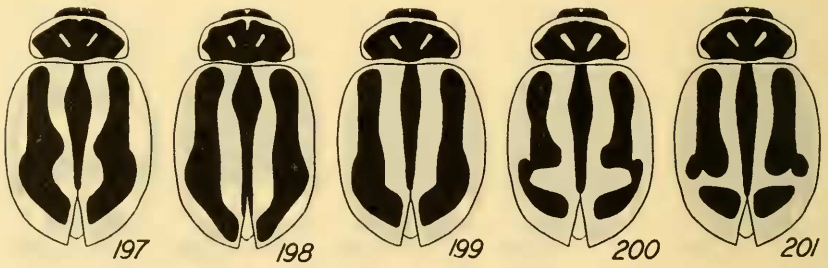
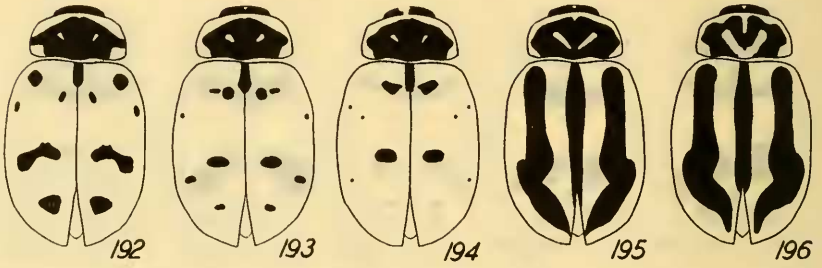
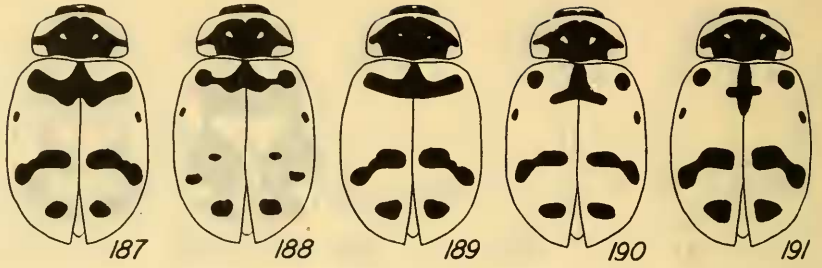
HIPPODAMIA

(For explanation, see pp. 36-37.)



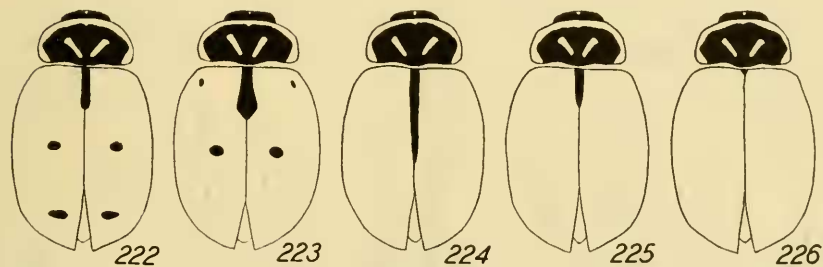
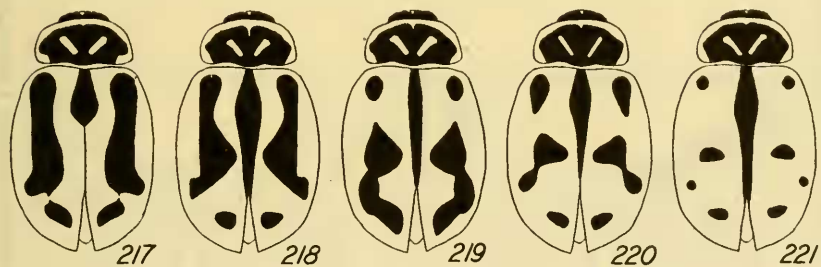
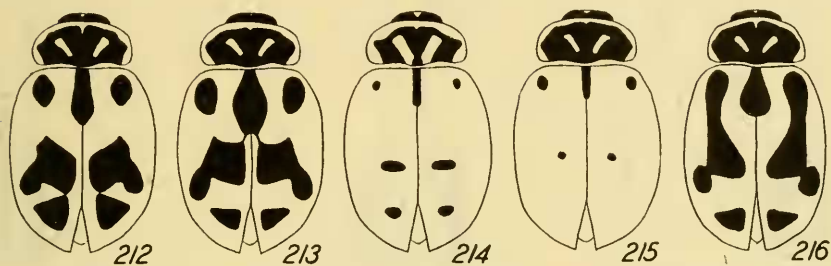
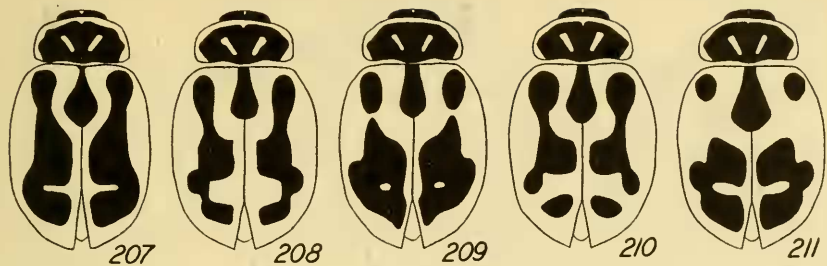
HIPPODAMIA

(For explanation, see p. 37.)



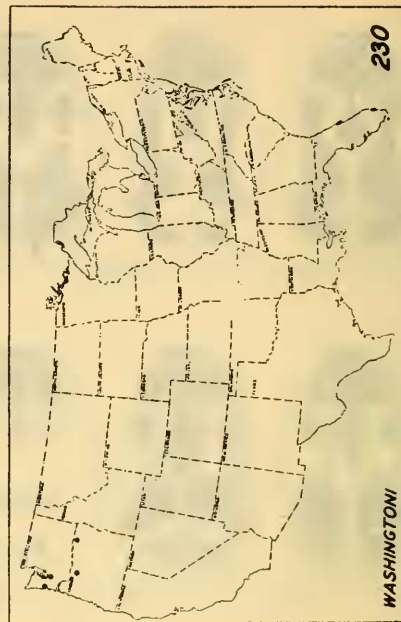
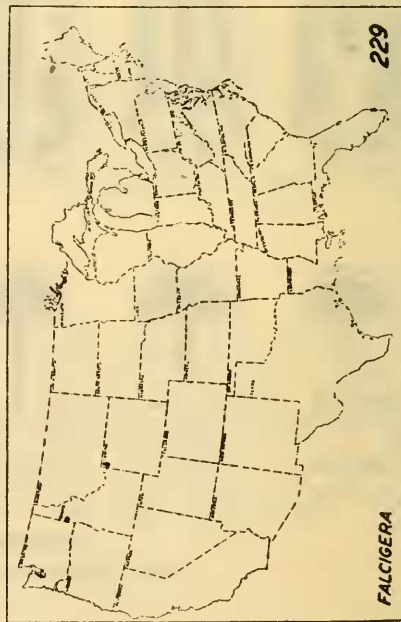
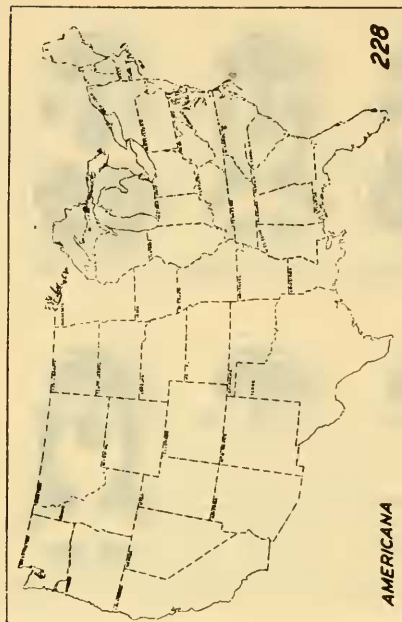
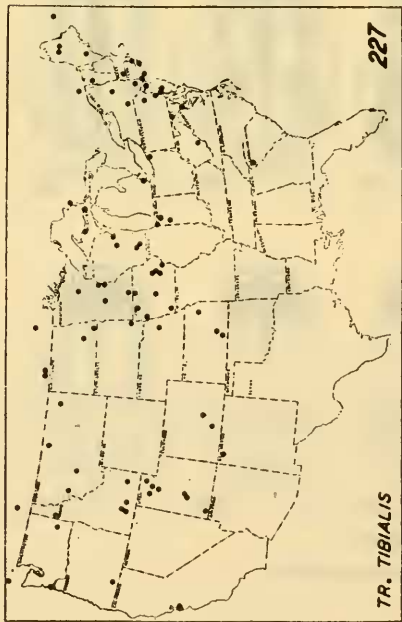
HIPPODAMIA

(For explanation, see pp. 37-38.)



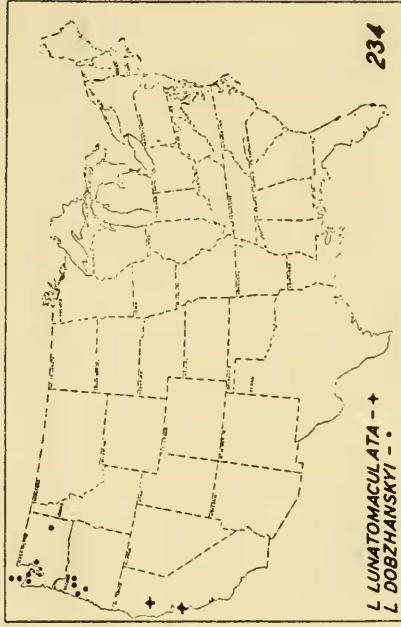
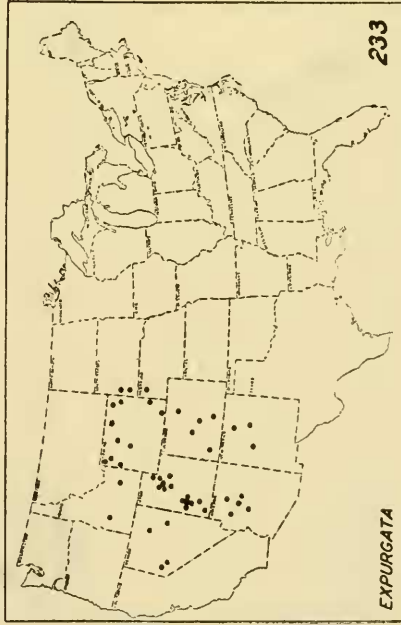
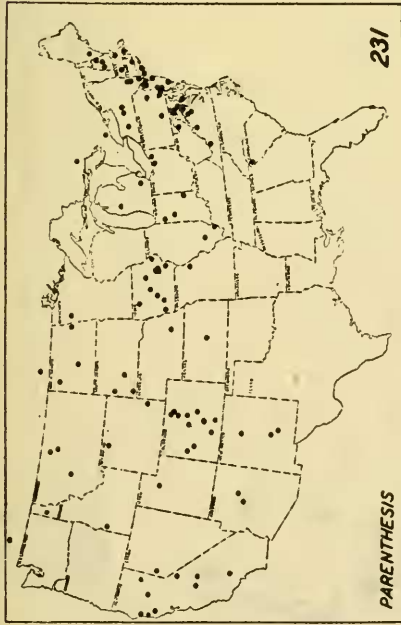
HIPPODAMIA

(For explanation, see pp. 38-39.)



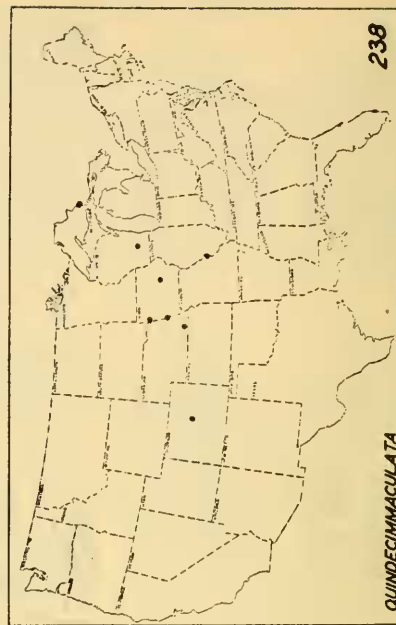
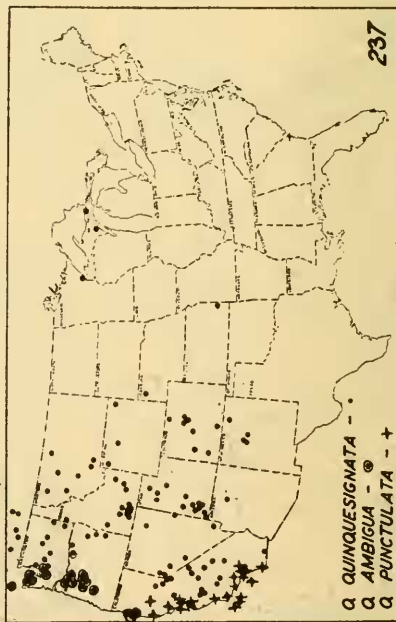
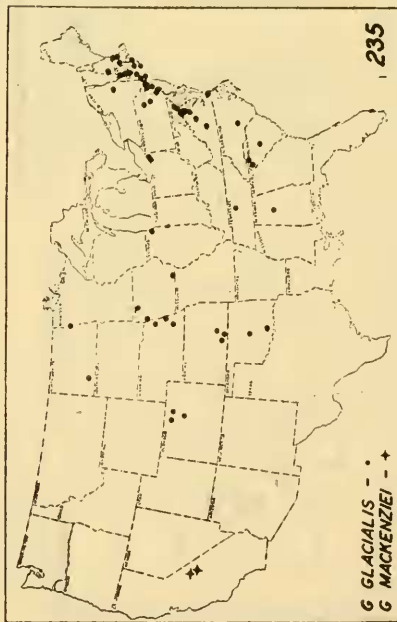
GEOGRAPHICAL DISTRIBUTION OF HIPPODAMIA

(For explanation, see p. 39.)



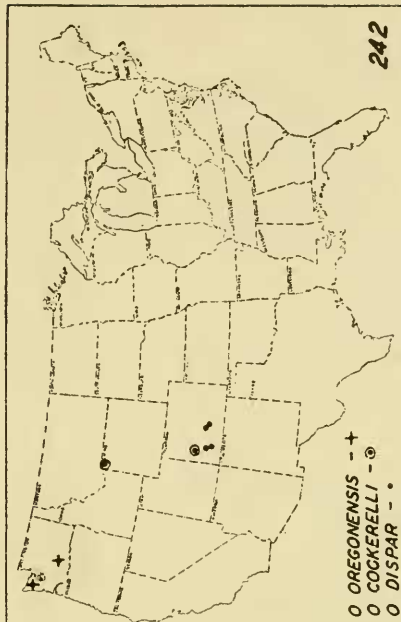
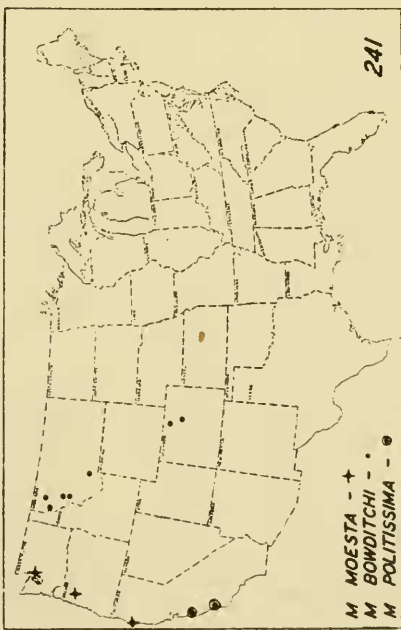
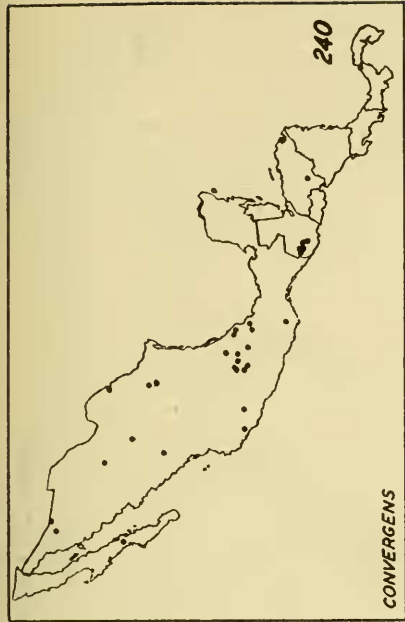
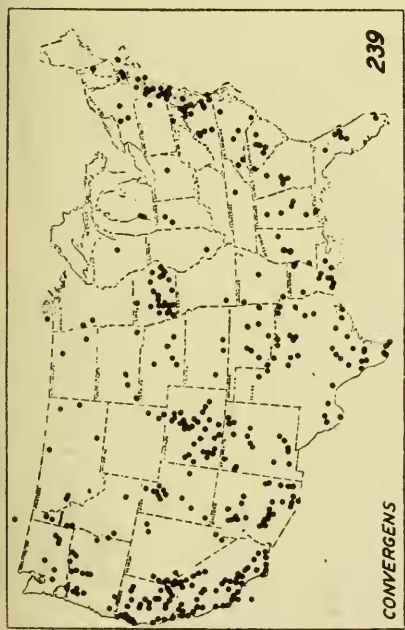
GEOGRAPHICAL DISTRIBUTION OF HIPPODAMIA

(For explanation, see p. 39.)



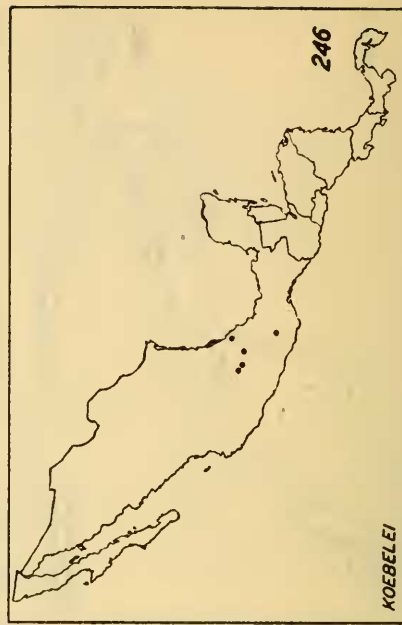
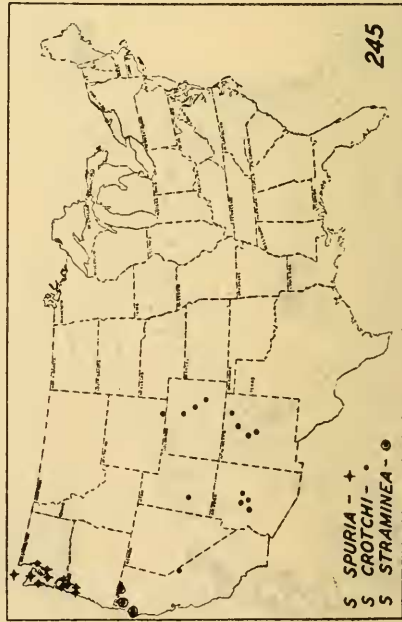
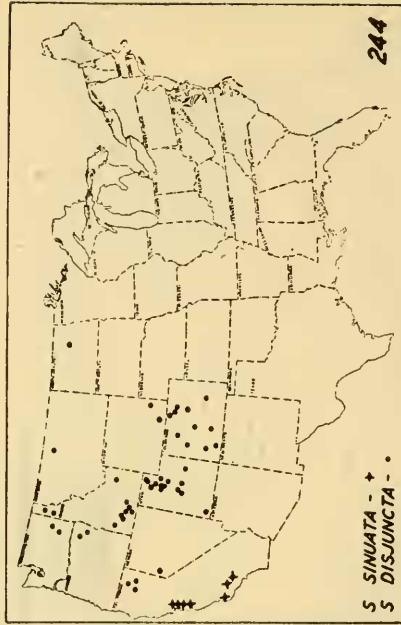
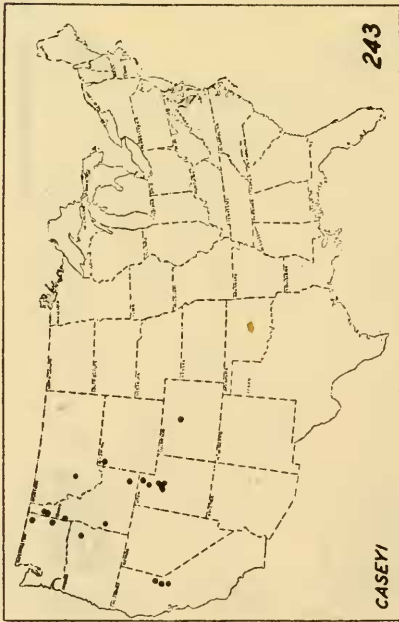
GEOGRAPHICAL DISTRIBUTION OF HIPPODAMIA

(For explanation, see p. 39.)



GEOGRAPHICAL DISTRIBUTION OF HIPPODAMIA

(For explanation, see p. 39.)



GEOGRAPHICAL DISTRIBUTION OF HIPPODAMIA

(For explanation, see p. 39.)